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guide to CROP PROTECTION in Alberta 1987

PART 1 CHEMICAL

Herbicides Insecticides Fungicides Rodenticides

Alberta
AGRICULTURE
AGDEX 606-1

87-03070/

POISON CONTROL CENTRE (ALBERTA)

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Calgary only
270-1414

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WHEN YOU CALL THE POISON CENTRE

1. Remain calm.
2. Bring the container and/or label with you to the phone.
3. Be prepared to answer some questions.
   - age and weight of patient
   - name and amount of product
   - time poisoning happened
   - any symptoms
   - circumstances surrounding the incident
   - your name and phone number
4. Follow instructions carefully.
5. Keep your line free if the Poison Centre has to return your call.
6. **DO NOT ATTEMPT ANY ADDITIONAL FIRST AID UNLESS THE POISON CENTRE HAS INSTRUCTED YOU.**

Copies of this publication may be obtained from:

Print Media Branch
Alberta Agriculture
7000 - 113 Street
Edmonton, Alberta, T6H 5T6
OR
Alberta Agriculture's district offices

Revised 1987 01 30M

GUIDE TO CROP PROTECTION IN ALBERTA

1987

PART I – CHEMICAL

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Alberta Agriculture
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Special thanks to **Beverley A. Ross, P. Ag.** for assistance in formatting and proofing.

THIS PUBLICATION IS INTENDED TO BE USED AS A GUIDE ONLY. INFORMATION CONTAINED HEREIN IS THAT AVAILABLE AT TIME OF PRINTING (JANUARY 9, 1987). WHILE EVERY EFFORT HAS BEEN MADE TO ENSURE ACCURACY, ALBERTA AGRICULTURE DOES NOT ACCEPT RESPONSIBILITY FOR LABEL CHANGES, ERRORS IN CONVERSION OR OTHERWISE. **CONSULT PRODUCT LABELS FOR FINAL DETAILED INSTRUCTIONS.**

ALL RECOMMENDATIONS IN THIS PUBLICATION ARE GIVEN IN QUANTITY OF COMMERCIAL PRODUCT PER ACRE (L OR KG/AC). PRODUCT LABELS ARE GIVEN IN QUANTITY OF PRODUCT PER HECTARE (L OR KG/HA). TO AVOID APPLICATION ERRORS BE SURE TO READ AND UNDERSTAND LABEL RECOMMENDATIONS.

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INSTRUCTIONS FOR USE OF GUIDE

This publication contains a set of foldout charts and descriptive text which must be used as a unit. When using, go through the following steps:

1. Identify the pests.
2. Refer to the appropriate foldout chart for the crop.
3. Record the pesticide(s) available from the chart.
4. Look up the pesticide(s) in the text and note characteristics, safety, method of application, effect on pest and crop, etc.
5. Select the product best suited to your need.
6. Apply according to instructions given on the label.

HERBICIDE PERFORMANCE RATINGS

Tolerance of Crop to Herbicides

The number appearing in brackets following the crop on which each herbicide is registered represents the expected tolerance of the crop to that herbicide. Due to variations in crop variety, weather, time of application and application techniques this number is only approximate and therefore should **only** be used as a guide when selecting a herbicide. 0 = complete kill of the crop; 9 = no measurable injury to the crop.

Level of Weed Control with each Herbicide

The number appearing in brackets after each weed represents the average level of weed control expected with the herbicide. Due to variation in weather, growth stage, time of day, application technique, etc. this number is only approximate and therefore should **only** be used as a guide when selecting a herbicide. 0 = no control of the weed; 9.0 = complete kill of the weed.

ADDRESSES AND TELEPHONE NUMBERS - CHEMICAL COMPANIES

BASF Canada Inc.
1700 - 521 - 3 Avenue S.W.
Calgary, AB T2P 3T3
(403)237-6661 Toll Free: 1-800-661-9245

Burlington Bio-Medical & Scientific Corp.
91 Carolyn Blvd.
Farmingdale, N.Y. 11735, USA
(516)694-9000

Chemagro Ltd.
2381 Ness Avenue
Winnipeg, MB R3J 1A5
(204)885-1661

Chipman
A Business Unit of C.I.L Inc.
P.O. Box 366, Station T
Calgary, AB T2H 2G9
(403)259-5966 Toll Free: 1-800-661-1348

Ciba-Geigy Canada Ltd.
909 - 8 Avenue
Regina, SK S4N 6S3
(306)352-2281 Toll Free: 1-800-667-1612

Cyanamid of Canada Inc.
7121 H - 6 Street S.E.
Calgary, AB T2H 2M8
(403)253-0924 Toll Free: 1-800-387-5073

Dexol Industries
Apache Seed Co.
10136 - 149 Street
Edmonton, AB T5T 1L1
(403)489-4245 or (403)489-0606

Dow Chemical Canada Inc.
2403 - 10104 - 103 Avenue
Edmonton, AB T5J 0H8
(403)428-0442 Toll Free: 1-800-661-6436

DuPont Canada Inc.
105 - 333 - 25 Street E.
Saskatoon, SK S7K 0L4
(306)244-4511 Toll Free: 1-800-667-3925

Elanco Products Division
Eli Lilly Canada Inc.
9635 - 45 Avenue
Edmonton, AB T6E 5Z8
(403)436-6131

Elston Equipment Co. Inc.
Goodwin Enterprises
R.R. #2
Sundre, AB T0M 1X0
(403)638-3215

Federated Co-operatives Ltd.
Box 1050
Saskatoon, SK S7K 3M9
(306)244-3208

Hoechst Canada Inc.
295 Henderson Drive
Regina, SK S4N 6C2
(306)924-2300 Toll Free: 1-800-667-5959

Kemsan Inc.
Box 5264, Station E
Edmonton, AB T5P 4C5
(403)484-8185

Later Chemicals Ltd.
12080 Horseshoe Way
Richmond BC V7A 4V5
(604)271-4224

Leffingwell Chemical Division
Thompson-Hayward Chemical Co.
OK Chemicals Ltd.
1673 Traut Road
Kelowna, BC V1X 4K4
(604)765-5733

Makhteshim-Agan (America) Inc.
c/o Ken Goudy Agri.Chemicals Ltd.
Box 3008
Melfort, SK S0E 1A0
(306)752-4584

May & Baker Canada Inc.
1274 Plains Road E.
Burlington, ON L7S 1W6
(416)634-2355

Monsanto Canada Inc.
55 Murray Park Road
Winnipeg, MB R3J 3W2
(204)885-6740

Peacock Industries Inc.
Box 217, RR3
Saskatoon, SK S7K 3J6
(306)225-4691 or (306)493-2527

ADDRESSES AND TELEPHONE NUMBERS - CHEMICAL COMPANIES

Pfizer Chemicals & Genetics Inc.
P.O. Box 2005
1 Wilton Grove Road
London, ON N6A 4C6
(519)681-2173

Rohm and Haas Canada Inc.
Suite 9 - 830 King Edward Street
Winnipeg, MB R3H 0P5
(204)774-1755

Sandoz Agro Canada Inc.
Suite 302 Plaza 4
2000 Argentia Road
Mississauga, ON L5N 1W1
(416)821-7850

Sanex Inc.
9577 - 60 Avenue
Edmonton, AB T6E 0C2
(403)438-1928

Savolite Industries
7610 A - 5 Street S.E.
Calgary, AB T2H 2L9
(403)258-1777

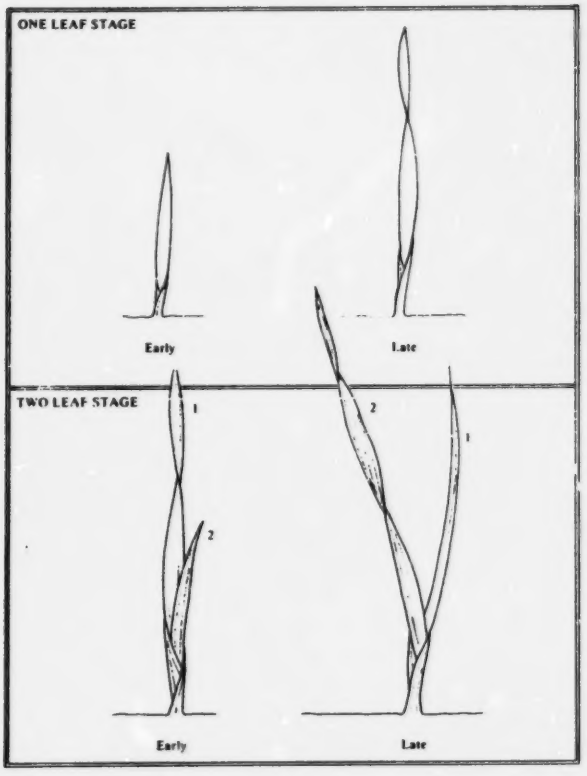
Transbas
P.O. Box 957
1525 Lockwood Road
Billings, Montana
USA, 59103
(406)245-4171

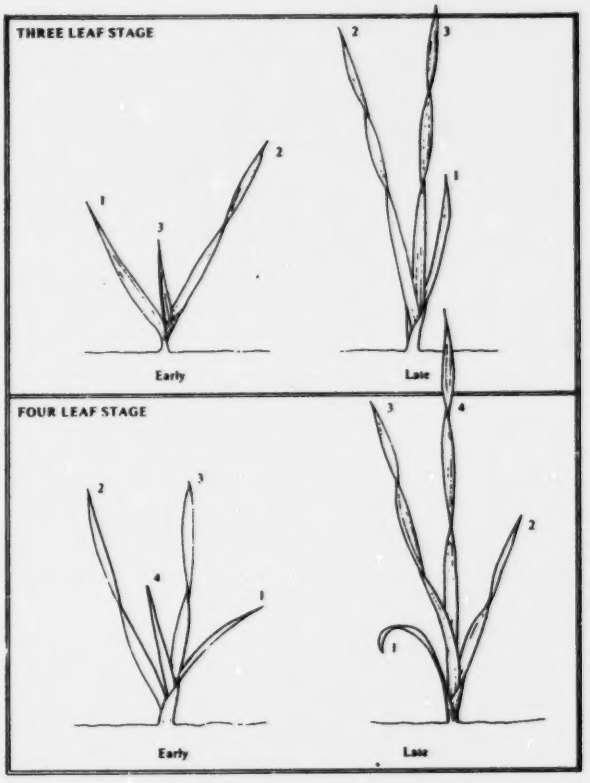
Union Carbide Agricultural Products (Canada) Ltd.
5507 - First Street S.E.
Calgary, AB T2H 1H9
(403)252-2272 or (403)253-8471

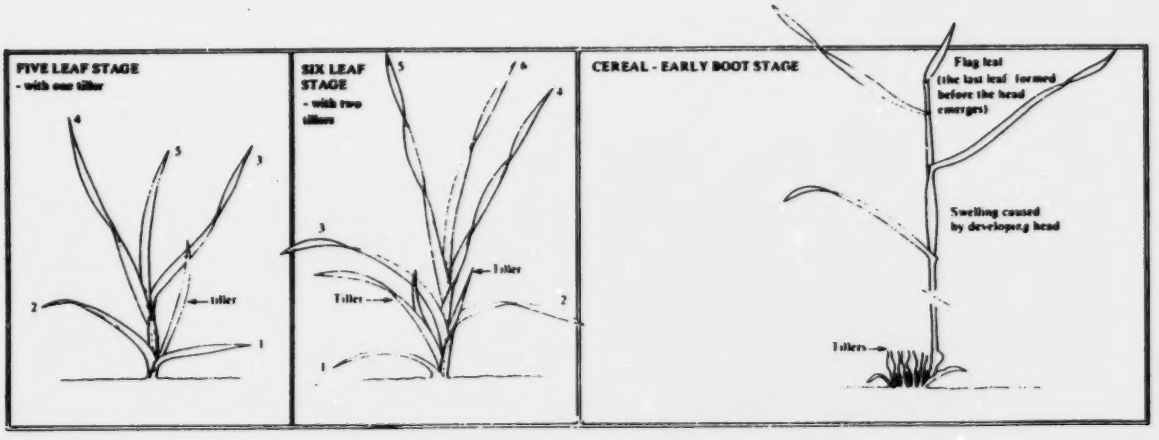
Uniroyal Chemicals
4 - 2216 - 27 Avenue N.E.
Calgary, AB T2E 7A7
(403)250-9481
24 Hour Emergency: (519)744-3060

Wilson Laboratories Inc.
36 Head Street
Dundas, ON L9H 3H3
(416)627-9205

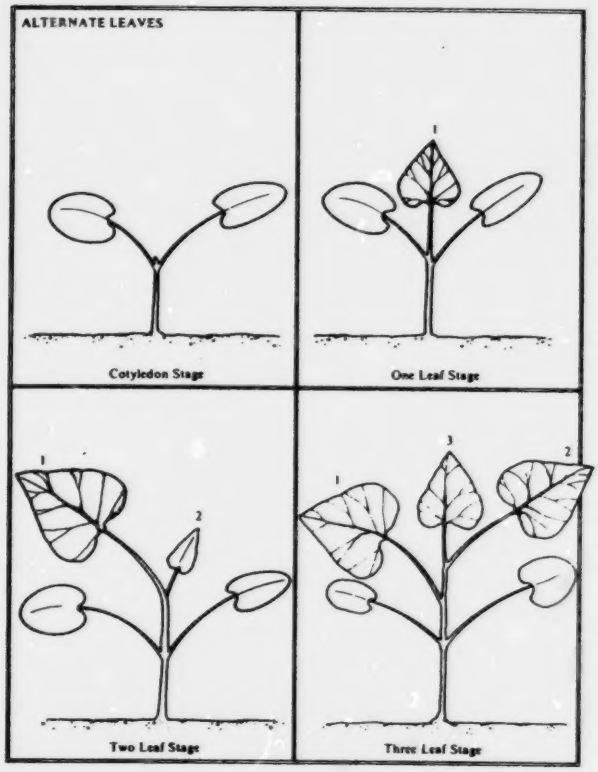
LEAF STAGES — CEREALS and GRASSES

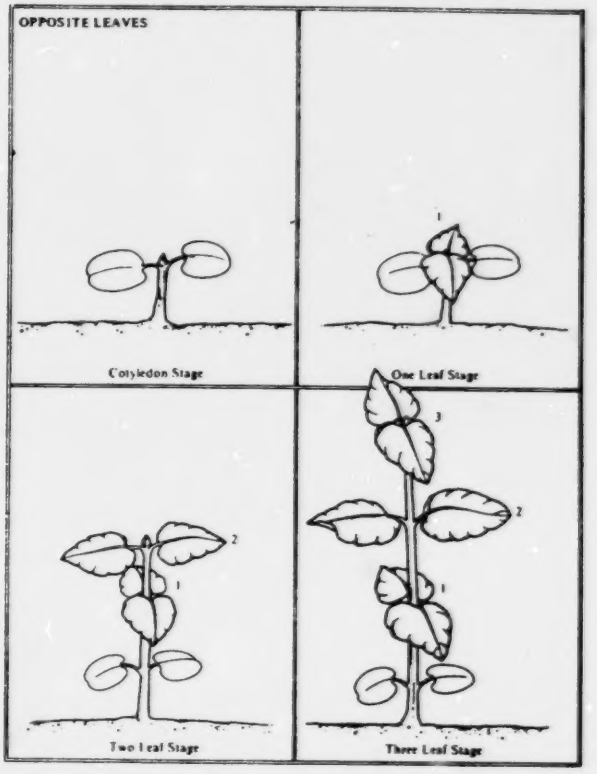


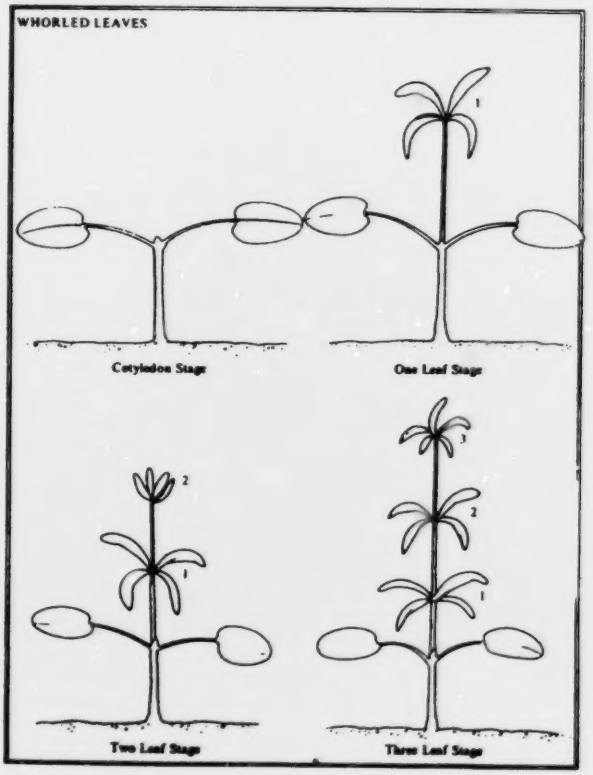




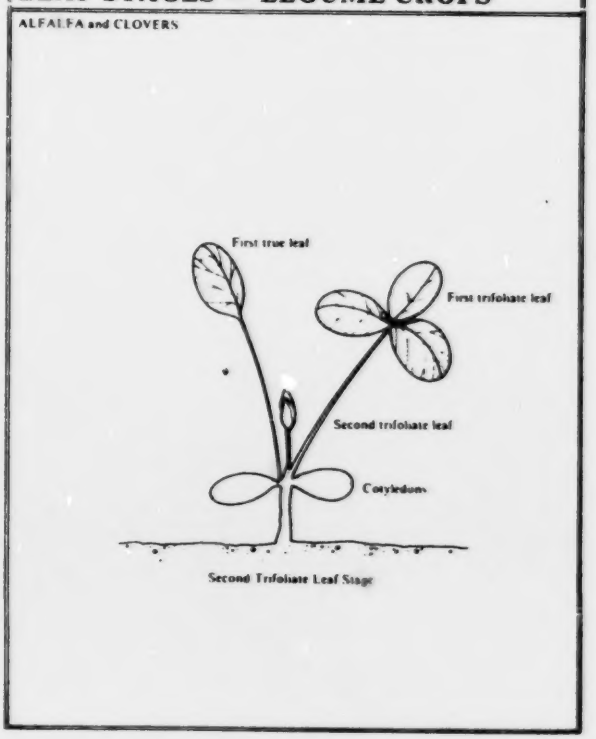
LEAF STAGES — BROADLEAVED WEEDS







LEAF STAGES — LEGUME CROPS



CHEMICAL PEST CONTROL IN ALBERTA

INTRODUCTION

This guide is to assist farmers to select and apply pesticides. Pesticides should be used in a management system including crops adapted to local climate and soil type. Use resistant varieties where available. Plant clean, disease free seed. A good seed bed and banded fertilizer give crops a head start on weeds. Use crop rotations, good sanitation and take care to prevent pests from overwintering. Destroy infestations at their source. Compared to the cost of pesticides these controls are cheap. Consider not only price and efficacy but also toxicity and persistence when choosing pesticides.

IDENTIFY THE PROBLEM EARLY

Often pest control occurs on an emergency basis but cheaper, more effective controls may be available if the problem is anticipated or detected early. Check fields often and anticipate problems, based on last year's situation.

AVOID UNSATISFACTORY RESULTS

(a) Crop damage or (b) Inadequate control.

Years of testing precede a pesticide registration and result in explicit instructions on the label. Most failures happen when the farmer does not completely follow these directions.

COMMON REASONS FOR PESTICIDE FAILURE

IMPROPER APPLICATION

1. **Failure to apply the recommended amount.** Where rate ranges are given, the minimum is for light infestations using good sprayers and techniques. Growing conditions have to be good and crop competition normal. For less favourable conditions or high pest populations use the high rate. Heavy textured and high organic soils require higher rates of soil applied herbicides.
2. **Poor equipment.** Applications made with worn nozzles, loose hitches, low pressure or inadequate water volumes result in less control and possible crop damage.
3. **Failure to incorporate** soil-applied herbicides soon enough or thoroughly enough may result in loss of activity due to evaporation or ultraviolet breakdown. Follow label instructions carefully and ensure soil is properly prepared.
4. **Use of water** with suspended silt, a high pH or high mineral content may reduce effectiveness.
5. **Poor application technique** such as incorrect boom height, incorrect nozzles or pressure, plugged filters or excessive speed for the terrain all contribute to poor results.

BAD TIMING

Each pest has a most susceptible and each crop a most tolerant stage. A common problem is treating too late, after the pests develop resistance. A rule of thumb is treat early within the proper stage.

SELECTION OF THE WRONG MATERIAL

Farmers rarely use a totally unsuitable pesticide but often several pesticides are available and they may not pick the best one available. Some of the weeds are controlled but better selection could control more species at no more cost. For best results examine the field and identify all of the weeds before making a selection.

WHAT TO DO IF RESULTS ARE UNSATISFACTORY

1. Compare your procedures, with the label instructions.
2. Check for plugged screens, nozzles worn or mixed by type or size.
3. Check calibration, work back from acres and amount of chemical.
4. Consider time since application. Some results are not apparent for several days. Look for early symptoms of the chemical taking effect.
5. If there are no results after a week seek technical help. Gather all relevant data, particularly evidence such as photos or dried specimens. Record wind, rainfall, soil moisture condition, crop variety, fertility and temperature at time of spraying, quantity of material used and acres treated.
6. Document everything in writing. If crop damage is involved submit a specimen for diagnosis. Disease or insect damage can resemble herbicide injury.

PROPER MIXING OF PESTICIDES

1. Fill the sprayer with half the required amount of clean water.
2. Shake the closed pesticide container vigorously.
3. Slowly add pesticide to sprayer with agitator operating.
4. Allow container to drain into sprayer for 30 seconds.
5. Fill container one quarter full of rinse water.
6. Shake container vigorously, drain into sprayer for 30 seconds.
7. Repeat this procedure three times.

8. Fill sprayer tank with water, spray at once.

9. Always agitate vigorously if sprayer has been standing for a time after mixing.

CHEMICAL MIXTURES

1. TANK MIXTURES
A tank mixture involves the mixing of two or more separate chemicals in the sprayer tank, as opposed to a mixture formulated by the manufacturer. For example, wild oat herbicides are frequently mixed with a broadleaf herbicide to control a wide range of weeds.

2. TANK MIX PROBLEMS
Crop injury and reduced pest control are the main problems associated with tank mixtures. Physical compatibility of the mixture must also be considered. Physical compatibility can be tested by mixing small amounts of each pesticide together in a jar of water and observing the reaction. Formation of precipitates or gums indicates incompatibility.

When herbicides for grassy weed control are mixed with herbicides for broadleaf weed control, a partial loss (sometimes total loss) of activity on grassy weed control is quite common. When reduced weed control is likely to occur the advantages of tank mixing are soon lost. For example, a five to ten per cent reduction in wild oat control is usually more costly than a second spraying of the field.

3. PREPARING A TANK MIX
The order in which the pesticides are added to the spray tank may be critical in avoiding physical incompatabilities. When mixing pesticides, go through the following steps:
   a. add 1/2 the required amount of water and mix with one pesticide,
   b. agitate,
   c. with agitator running, add the other pesticide.

To reduce the possibility of formation of precipitates or gums which may clog nozzles and filters, add pesticides to the spray tank in the following order:
   a. Soluble Powders
   b. Wettable Powders and Flowable Liquids
   c. Solutions (amines and salts)
   d. Additives (surfactants)
   e. Emulsifiable Concentrates (esters)

For specific mixing instructions always check the product labels as there may be exceptions to the mixing order.

4. RATE TO USE IN PREPARING A TANK MIX
Unless stated otherwise, use the single rate application of each pesticide. That is, the amount you would use if each pesticide is applied separately. **CAUTION:** Always check the label of each product to ensure you have the accurate rate.

ADJUVANTS (SURFACTANTS, WETTING AGENTS, SPREADERS, ETC.)

Adjuvants encompass a broad category of compounds added to a pesticide to enhance application and/or performance. Pesticides are generally formulated with the proper amount of adjuvant and additional quantities are not usually required. If adjuvants are considered, USE ONLY THOSE PRODUCTS NAMED AND RECOMMENDED ON THE LABEL. Failure to do so could result in: (a) crop injury, (b) reduced pest control, (c) chemical residue in the crop, (d) invalidation of pesticide warranty.

The most common group of adjuvants used in pesticides is SURFACTANTS. Surfactants facilitate and enhance the emulsifying, dispersing, wetting, spreading, sticking, penetrating or other surface-modifying properties of liquids to bring about enhanced pesticidial action. Since these chemicals produce physical changes at the surface of liquids, surfactants are often referred to as ***surface-active*** agents.

Surfactants can be generally classified into two major groups based on their ionization in water: ionic or non-ionic.
Ionic surfactants ionize when mixed in water, that is, divide into two changed entities - a positively charged ion (cation) and negatively charged ion (anion). An example is ammonium sulphate ($2\ NH_4^+ + SO_4^{--}$).

Non-ionic surfactants do not ionize in water. Consequently, they are unaffected by hard water, can be used in strong acid solutions, and more soluble in cold water than in hot water (an inverse temperature-solubility relationship). Non-ionic surfactants now constitute a sizable portion of the total production of surfactants. Some of the commonly recommended ones for herbicide mixtures are: Agral 90, Ag-Surf, Citowett Plus, Triton XR, Tween 20.

SOIL STERILANTS

All sterilants are growth preventers. They are poor killers of older weeds; they should be applied in the spring before growth begins or in the fall after growth ceases (before ground freezes). If application is made to established growth use a top kill material with the sterilant.

Water volume required for application of the soil sterilants is not critical, but even distribution over the ground surface is. Depending upon equipment used and foliage density this may vary between 100 and 1000 L/ac.

Soil sterilants are generally wettable powders. Make a slurry of the chemical in a separate container - fill sprayer tank with half the required amount of water. While filling the tank and with the agitator operating pour the slurry into the tank. Do not stop the agitator until the tank is empty. If by-pass agitation is used, ensure the line enters the bottom of tank to minimize foaming. Continuous gentle agitation is required to prevent settling out - heavy agitation will cause foaming and application problems. • All screens and filters throughout the spraying system should be no finer than 50 mesh. Never use felt filters. After using soil sterilants the equipment should be thoroughly washed, and rinse water disposed of on the treated site. • Most sterilants are relatively insoluble and become attached to soil particles - however heavy rainfall may cause physical movement of both chemical and soil particles and if the slope is steep movement will be substantial. Do not apply to slopes. Remember that after use of these products there will be no plant growth to slow erosion. • Bare ground will be maintained for 12-14 months after application. After this time the chemical will have moved out of the top 2-3 cm of soil surface and shallow rooted annual weeds and grasses will germinate. As they develop and send roots deeper into the chemical layer they will die, however there will always be new seeds germinating. By 24 months after application the "clean" layer of soil may be 6-8 cm deep and weed growth will be more obvious. At this time it may be necessary to apply a lower, reinforcing rate of soil sterilant. • Each product will leave a group of plants which are slightly tolerant. If more than two successive applications are made results will appear quite unsuccessful as these tolerant plants will predominate. The solution is to rotate products.

CONSERVATION TILLAGE AND HERBICIDES

Conservation tillage is a general term used to describe a cropping program in which some or all of the tillage operations are replaced by using herbicides to control weed growth and at the same time preventing soil erosion and conserving soil moisture. The following terminologies are included under conservation tillage: reduced tillage, minimum tillage, no-tillage or zero tillage, direct drilling and chemical fallow.

Herbicides for conservation tillage are listed below. Rates of application, weeds controlled and other pertinent information can be found by referring to each herbicide in this guide.

1. **2,4-D or MCPA:** To control winter annuals such as flixweed, shepherd's-purse, and stinkweed. Application should be made to emerged weeds prior to freeze-up.
2. **Glean:** In the Brown and Dark Brown soil zones, Glean can be applied in the fall prior to planting spring wheat or summer fallowing. Glean can be tank mixed with Roundup.
3. **Heritage:** Use in the Brown soil zone only during the fallow year.
4. **Roundup:** Apply Roundup mixed with a non-ionic surfactant to actively growing weeds. Roundup can be tank mixed with Banvel; 2,4-D amine; Glean; Pardner; or Torch DS.
5. **Sweep:** Controls annual grasses and broadleaf weeds. Can be tank mixed with bromoxynil+MCPA; dicamba +2,4-D; linuron+MCPA; 2,4-D; MCPA. Apply Sweep+linuron+MCPA only once per year in spring only.

NITRATE POISONING DUE TO HERBICIDE ACTION

Nitrates are the major form in which plants take up nitrogen to be used by the plant for making protein and other nitrogen compounds that are important for plant life and growth. In normal circumstances nitrates are converted to these other products at about the same rate that they enter the plant. Under some conditions nitrates accumulate because they are entering the plant faster than they can be converted. Nitrates combine with blood hemoglobin, reducing oxygen utilization. The poisoned animal can die from suffocation.

Nitrate accumulations may be caused by leaf damage from frost, hail, or herbicide action. After severe frost, hail, or herbicide damage the nutrient value of the crop will decrease rapidly. From a feed value point of view it is important to harvest as soon as practical - however in the case of herbicide treated crops there may be a waiting period specified on the label and in the case of high risk crops, such as oats or corn a delay may be advisable to permit nitrate levels to decrease. If there is a possibility of high nitrates in a feed, have it analysed at a feed testing laboratory. A veterinarian should be called immediately if livestock are showing unusual symptoms when they are being fed forages containing nitrates. Symptoms of nitrate poisoning include reduced milk production and growth rate, abortions and in severe cases death by suffocation.

PLANT GROWTH REGULATORS (PGR'S)

Plant Growth Regulators (PGR's) are chemicals which affect the normal growth process of plants. Unlike herbicides, they are generally used on crop plants for beneficial effects such as increased yield, promotion of flowering, reduction in lodging, etc. For example, Cerone is a PGR registered for use on four varieties of barley.

REDUCING EXPOSURE TO PESTICIDES

1. TOXICITY

Before using a pesticide, you may want to know how hazardous it is or if it can cause health problems. The hazard is dependent on the toxicity of the pesticide and length of time you are exposed to it.

Toxicity is the ability of the pesticide to cause symptoms, severe poisoning, or death and is expressed as the LD_{50}. The oral LD_{50} is the one single amount of the pesticide that will kill half of a group of test animals when the pesticide is fed to the animals. If you know the LD_{50}, you can have a good idea of how much precautions you need to take to reduce exposure and avoid getting symptoms. The smaller the LD_{50} of a pesticide, the more toxic it is.

The following table relates the oral LD_{50} (mg/kg) of a pesticide to its toxicity.

LD_{50} less than 500 mg/kg	LD_{50} of 500-1000 mg/kg	LD_{50} of 1000-2500 mg/kg	LD_{50} greater than 2500 mg/kg
indicates high toxicity	indicates moderate toxicity	indicates low toxicity	indicates very low toxicity

DANGER POISON

WARNING POISON

CAUTION POISON

There are a few pesticides however, which are low in toxicity but could cause chronic health problems due to long term exposure. Many older pesticides are not tested according to new safety standards; as new tests are done on them it is possible that some may be shown to cause potential health problems. Therefore, to be on the safe side, you should take precautions when using all pesticides whether they are very toxic or non-toxic. The idea is to reduce exposure to all pesticides as much as possible.

2. ROUTES OF EXPOSURE

Pesticides may enter the body through the skin (dermally) and mouth (orally), and by inhalation. Penetration through the skin is the most common way and occurs when the concentrated chemical is being handled, or the dilute material is being sprayed without proper safety clothing. Immediate illness may occur once enough chemical enters the body. Although many pesticides do not penetrate the skin, they may still cause skin problems such as redness, blisters, or dry scaliness that may lead to serious skin eczema and dermatitis.

Pesticides may enter the body through cuts, scrapes and bruises which should be covered with band-aids or bandages. Eyes are very sensitive to pesticides. They can be exposed to vapour or fumes, spray drift, or accidental spills and splashes when containers of liquid concentrates are being opened or when the concentrated chemical is being poured into the sprayer tank.

Pesticides can enter through the mouth when a farmer eats or smokes with contaminated hands or when he licks his lips. Children may be poisoned if they drink pesticides stored in pop bottles. All pesticides should be stored in their original containers in a securely locked area out of reach of children.

Pesticides can also enter the body through the inhalation of fumes, dusts, or spray mists. In the case of fumes and extremely fine particles of dust or spray, complete absorption of chemical by the lungs can occur and the hazard is high.

3. STANDARD SAFETY PRECAUTIONS

Whenever working with pesticides, wear standard protective clothing: long sleeve shirt, full length pants, coveralls, rubber boots, and cap.

In addition to the standard clothing, use common sense to decide what extra protection is needed for a particular job. Sometimes the label on the pesticide container gives details of extra precautions required. Extra protective equipment is rubber or neoprene gloves, goggles, respirators, and gas masks.

a. *Coveralls:* Two types of coveralls are available: reusable and disposable. Reusable cotton coveralls are washable and can be used again and again. Disposable paper coveralls are usually more comfortable in hot weather and are lightweight. If they become damaged or severely contaminated, they should be discarded. Wash cotton coveralls after every pesticide application or when contaminated. Disposable coveralls can be discarded at a landfill site.

b. *Rubber boots:* Do not wear leather boots or sneakers as they absorb pesticides and are difficult to clean. The legs from the coveralls should be outside the top of the boots to prevent spills and splashes from running into the boots. If the inside of the boots is contaminated, it should be washed out immediately.

c. *Caps:* Prevent powders, dusts, or spray mists being deposited on the hair or scalp and be absorbed into the body.

d. *Gloves:* These are required when handling, mixing, or pouring concentrated pesticides. Rubber or neoprene are recommended but they should be washed very soon after use as the chemical may penetrate into the material. Do not wear leather or cloth gloves. These materials soak up the chemical and become a source of continuous contamination. Gloves with holes should not be worn. The sleeves of the coveralls should be worn outside the gloves to prevent spills and splashes from running into the gloves.

e. *Goggles:* Eyes should be protected with goggles, which are resistant to chemicals and have ventilation to prevent fogging.

f. *Respirators:* PERMANENT RESPIRATORS have one or two cartridges screwed on to a facepiece. Each cartridge contains a prefilter which removes dust particles and a filter of activated charcoal which absorbs the chemical. The cartridges are unscrewed and discarded as soon as any odour of the pesticide is detected in the facepiece. Permanent respirators are cleaned after each day's use: unscrew the cartridges and wash the facepiece with soap and water. Rinse the facepiece in clean water, dry with a clean cloth, and screw on the cartridges. The clean respirator should be stored in a sealed plastic bag to prevent cartridges from absorbing air borne contaminants. DISPOSABLE RESPIRATORS have the prefilter and filter in one cartridge that is permanently attached to the facepiece. The entire respirator is discarded when any odour is detected in the facepiece. These respirators should also be stored in a sealed plastic bag. **SPECIAL NOTE:** Farmers should buy respirators and cartridges approved for use with pesticides. Gauze and dust masks are not respirators and are not recommended for pesticide dusts.

g. *Gas Mask:* These are used when a farmer is likely to be exposed to very high levels of pesticides. The facepiece covers the eyes, nose and mouth. It is connected by a flexible hose to a charcoal canister worn on the belt. The lifespan of this canister is longer than that of the respirator cartridges. Manufacturer's directions are to be followed for cleaning and storing gas masks and canisters.

h. *Tractor Cab Filters:* Recently a charcoal filter was invented by a Saskatchewan farmer to fit onto a tractor and to filter out pesticides from the air entering the tractor cab. For more information on this filter, contact Merit-Aire Ltd., Box 337, Raymore, Saskatchewan, S0A 3J0, Phone (306)746-4484.

4. CLEANING PESTICIDE-CONTAMINATED CLOTHING

- wash pesticide-soiled clothing separately from regular family laundry;
- pretreat pesticide-soiled clothing with a laundry stain removal product intended for oil stains when an oil-base (emulsifiable) formulation has been used;
- avoid overcrowding clothes in the washing machine;
- pre-rinse pesticide-soiled clothing on presoak cycle of automatic washer;
- use heavy duty detergent;
- use hot water setting, full water level, normal cycle;
- wash clothes twice or three times;
- after use, run machine through full cycle with hot water and detergent to rinse washer;
- line dry clothes to prevent possible contamination of dryer and to increase the chemical breakdown of pesticide residues;
- wash hard hat, goggles, respirator (avoid getting charcoal filter wet, remove if possible), gloves and rubber or neoprene boots in hot soapy water daily.

5. SAFETY EQUIPMENT STORES

Safety clothing and equipment are sold by U.F.A. Co-op, Fleck Bros., Levitt Safety, and Safety Supply.

6. POISON INFORMATION CENTRES **(Alberta) 1-800-332-1414 (Calgary only) 270-1414**

The emergency department of most hospitals can deal with pesticide poisoning. However, the Poison Centre in Calgary can provide information on recognizing poisoning symptoms and in giving the right treatment.

Some manufacturers have emergency telephone numbers to call in case of pesticide poisoning.

Chipman	Cyanamid	Monsanto	Union Carbide	Uniroyal
1-416-528-6771 1-416-643-4123	1-416-356-8310	1-314-694-1000	1-514-645-5311	1-519-744-3060

7. STANDARD FIRST AID MEASURES

Before using a pesticide, look for the hazard symbol on the label. This indicates the toxicity of the pesticide. If you are severely exposed to a pesticide and you are alone, DO NOT PANIC. The symptoms of the pesticide do not show up immediately. You will have some time to decontaminate yourself.

IF ON SKIN - Get any spilled pesticide off your body immediately. If the pesticide is on your clothes, remove them and rinse your skin with water. After rinsing, wash the area with soap and water.

IF IN EYES - wash eyes with water at once. Hold the eyelids open and wash eyes for at least 15 minutes with fresh water each time. Get help to take you to the emergency department of the nearest hospital and take the labelled container with you. Do not use any eye medication unless prescribed by a doctor.

IF SWALLOWED - read the label under FIRST AID INSTRUCTIONS to **determine whether or not to induce vomiting.** Usually if the formulation contains PETROLEUM DISTILLATES, vomiting should NOT be induced. If the label recommends vomiting, do so at once. **Induce vomiting by** drinking 1 or 2 glasses of water then sticking finger down throat **OR** swallowing syrup of ipecac (adult doses 30 mL; children under 12 years, 15 mL) followed by water to enhance vomiting. Do not induce vomiting in an unconscious or convulsive person. The person could choke to death on the vomit fluid. Get to the nearest hospital as soon as possible.

8. OTHER PRECAUTIONS AND SAFETY TIPS

a. Control systems using electrically operated solenoid valves are available. These allow sprayers to be controlled remotely, preferably from within a cab. Cabs provide some protection against spray drift and a good tight cab with filtered air intake should reduce but not eliminate operator exposure. The use of the special charcoal filter designed by the Saskatchewan farmer could further reduce pesticide exposure inside the tractor cab (see tractor cab filters).

b. After spraying pesticides, the inside of the tractor (seat, steering wheel, etc.) can be decontaminated by wiping with warm soapy water and a sponge.

c. Bees may be affected by pesticides or honey may be contaminated. Avoid spraying near hives or contaminating puddles of water from which bees may drink. Spray early in morning or late in afternoon when bee activity is at minimum. Warn beekeepers of your intentions so they can confine the bees or move them until spraying is over.

PESTICIDE CONTAINER DECONTAMINATION AND DISPOSAL

In Alberta, the following procedure should be used when decontaminating and disposing of pesticide containers even though the label suggests alternate forms of disposal.

1. Triple rinse container with water and put the rinse water into sprayer tank.
2. Crush or puncture container, never reuse the container for other purposes.
3. Deliver containers to an approved pesticide container collection site (contact local agricultural fieldmen for the site closest to you).

Only paper containers may be burnt but delivery to an approved pesticide collection site is highly recommended.

SPRAYER CALIBRATION

Accurate calibration of spraying equipment is an important aspect of chemical usage. An application of more than the recommended rate is wasteful and may damage the crop; applications of less than the recommended rate may be ineffective; again wasteful.

Preliminary Adjustments and Settings

- Preliminary adjustments and settings include all of the adjustments that are made when the machine is being prepared for use.
- Before starting to spray, check wheel bearings and tire inflation, and lubricate moving parts as recommended in the operator's manual. Tighten any loose bolts or nuts.
- Install tips, screens, check valves, and any other equipment that has been selected. Be sure fan nozzles are aligned so patterns overlap slightly but do not interfere with each other.
- Boom height depends on the spray angle of the tips selected. Set the boom at the required height and level it from side to side. Improper height causes non-uniform application.

Nozzle Calibration

The output of individual nozzles must be within 5% of the average nozzle output if an even volume is to be applied over the width of the sprayer. Nozzles with outputs either above or below this value must be cleaned and/or replaced.

1. Check and clean all nozzles, screens, and filters.
2. Check pressure gauge for accuracy.
3. Check boom pressure with an accurate gauge, and compare to sprayer gauge (both should be indentical).
4. With sprayer operating at the desired spraying (boom) pressure, using water only, collect nozzle output for 30 seconds. If ball check valves are used, the pressure should be increased by 35 kPa.
5. Measure and record collected amount.
6. Repeat steps 4 and 5 for all nozzles.
7. Replace nozzles that have an output 5% greater than average; clean and recheck nozzles with outputs of less than 5% of average (replace if necessary).

Brass nozzles should be recalibrated every 25 hours and stainless steel nozzles should be recalibrated every 50 hours. The use of wettable powders will require more frequent recalibration of all nozzles.

Ground Speed Determination

Ground speed can be determined by measuring the distance travelled in one minute. Repeat the test several times and average the results. Remember to use the same throttle setting (tachometer) and transmission gear each time. Run the tests in the field to be sprayed and have the sprayer tank half-full. Soil surface and load can affect ground speed and a half-full tank represents the average load. The sprayer must be at full speed before starting the test run.

Ground Speed Chart

Speed in km/h	5.0	5.5	6.0	6.5	7.0	8.0	9.0	10.0	11.0	12.0
Seconds to Drive										
60 metres	45	39	37	34	30	27	24	22	19	18
90 metres	68	58	54	51	45	41	36	34	29	27

Sample Nozzle Chart

Nozzle	Pressure kPa	Litres per Minute	Litres per Acre (50 cm spacing) 6 km/h	8 km/h	9 km/h	10 km/h
8001 or 11001	275	0.38	30	22	20	18
80015 or 110015	275	0.57	45	34	30	27
8002* or 11002	275	0.75	60	45	40	36

*STANDARD Tips for 40 L/ac at 275 kPa and 9 km/h.

Calibration Procedure – Litres per acre (L/ac)

	Procedure	*Example*
1:	Field size	40 acres
2:	Sprayer tank capacity	1400 litres
3:	Determine spray volume (standard is 40 L/ac)	40 L/ac (from label - L/ha X 0.4047)
4:	Calculate spray required for entire field	40 acres X 40 L/ac = 1600 litres
	NOTE: In this example the tank holds 1400 litres. It will only cover 35 acres at 40 L/ac. A second tank with 200 litres of solution will be needed to complete the 5 acres.	1600 litres - 1400 litres = 200 litres 1400 litres ÷ 40 L/ac = 35 acres
5:	Select nozzle and speed from Sample Nozzle Chart	11002 nozzle at 275 kPa at 9 km/h = 40 L/ac
6:	Add chemical to water in tank (see label)	1.5 L/ha X 0.4047 = 0.607 L/ac
	A tankful will cover 35 acres, therefore:	35 acres X 0.607 L/ac = 21.2 litres of chemical
	The second tank will require:	5 acres X 0.607 L/ac = 3 litres of chemical
7:	Set pressure at 275 kPa. Drive at 9 km/h. At this speed it takes 36 seconds to travel 90 metres.	

NOTE: Speed check should be done on a soil surface similar to that which will be sprayed. For nozzles or speeds not included refer to manufacturer's data or ***Guide To Crop Protection In Alberta Part III – Pesticide Application Equipment.*** If spray charts are not available for your nozzles the following formula may be used to establish their spray volume at a set pressure and speed.

$$\frac{24{,}282 \times \text{L/minute (one nozzle)}}{\text{km/h} \times \text{nozzle spacing (cm)}} = \text{L/ac}$$

1. Adjust pressure to recommended setting (label).
2. Measure output of one nozzle (all nozzles must be equal).
3. Establish ground speed you will use.
4. Measure nozzle spacing (usually 50 cm).
5. Then use the above formula.

Example: 8002 nozzle at 275 kPa has an output of 0.75 L/minute and will apply 40 L/ac at 9 km/h (from chart).

$$\frac{24{,}282 \times .75 \text{ L/minute}}{9 \text{ km/h} \times 50 \text{ cm spacing}} = 40 \text{ L/ac}$$

AIRCRAFT APPLICATION

Aircraft applicators must take care to get even distribution of pesticides, and avoid damage to crops. The following suggestions are offered to help minimize these hazards.

1. **To get best coverage of crops and minimize the loss of spray to the atmosphere** - Spray in winds under 15 km/h. For best results apply herbicides in volumes not less than 14 L/ac. Fly as low as is safe. Width of swath should not be more than 1.25 of wingspan. Space the nozzles on the boom to give uniform distribution in the swath in spite of swirl from propeller and vortexes at the wing tips.
2. **To avoid drift damage from aircraft application** - Do not spray when wind is blowing toward a sensitive crop, shelterbelt or garden. Safe distances cannot be given. Do not spray in dead calm near sensitive plants. Do not apply volatile herbicides near a sensitive crop, shelterbelt or garden since the vapors rising from the field after application may be blown onto these plants.
3. **To Avoid Injury to Crops** - Use water as a carrier in preference to oil as injury is less likely. Apply at "safe" growth stage of the crop. Select the best chemical for the crop and weeds that are present and use only enough material for the degree of control desired.

CONVERSION TABLES

Benchmarks

Standard Application Volume:	40 litres per acre (L/ac) = 100 litres per hectare (L/ha)
Standard Spraying Pressure:	275 kilopascals (kPa) = 40 pounds per sq. inch (psi)
Standard Speed For Spraying:	9 kilometres per hour (km/h) = 5.6 miles per hour (mp/h)
Standard Nozzle Spacing On A Spray Boom:	50 centimetres (cm) = 20 inches (in)
Standard Height Above Target for 80 Degree Nozzle Tips:	45 centimetres (cm) = 18 inches (in)
Standard Nozzle Tips:	8002 or 11002

NOTE: A standard nozzle has an output of 0.75 litres per minute at 275 kPa. At 9 km/h these nozzles will apply 40 L/ac of spray.

Metric Equivalents

1 acre	=	0.405 hectare
2.471 acres	=	1 hectare
6.9 kPa	=	1 psi
1.6 km/h	=	1 mp/h
2.54 cm	=	1 inch
1 Litre/ac	=	2.5 L/ha

GLOSSARY OF TERMS IN PEST CONTROL

Acaricides	Pesticides which kill ticks and mites.
Active ingredient(a.i.)	The concentration of chemical in a formulated product that is responsible for action.
Adjuvant	A substance added to a pesticide formulation or mix to improve the physical properties of that pesticide and hence its effectiveness. e.g. surfactants, wetting agents, spreaders, stickers, and emulsifiers.
Antagonism	Opposing action of different chemicals such that the sum of their total effect is less than the effect if each pesticide were used alone.
Antidote	A first aid treatment to offset the toxic effect of a pesticide.
Bioassay	Determination of concentration of a herbicide by use of a sensitive indicator plant.
Carbamates	Insecticides which kill by temporarily tying up the cholinesterase located between nerves thus interfering with the transfer of messages across nerves.
Carrier	Liquid or solid used to facilitate application of a pesticide.
Chlorotic	Loss or fading of green colour in foliage.
Contact herbicide	A herbicide that causes localized injury to plant tissue, only where contact occurs.
Crop canopy	Covering or umbrella of crop plants over weeds and ground below.
Degradation	Breakdown of a pesticide by action of air, water, sunlight microbes or other agents.
Desiccant	Chemical use to accelerate drying of plant tissues.
Efficacy	Effectiveness of chemical on the pest.
Foliar application	Made to the leaves of plants, as opposed to soil application.
Formulation	Form in which the manufacturer prepares a pesticide to facilitate its use - granular, solution, emulsifiable concentrate, dry flowable, liquid flowable, wettable powder.
Fumigant	Vapour active chemical used against pests.
Half-life	Time required to breakdown 50% of a pesticide.
Headland	Field margin or roadway.
Incompatibility	Where one pesticide cannot be satisfactorily mixed with another - Mixture may gel, lose activity, settle out or be phytotoxic.
Inhibit	Prevent or stop a process e.g. inhibits photosynthesis.
Lime-based herbicide	A granular formulation in which the active ingredient is attached to a lime particle.
Metric measurements	mm=millimeter=.001 m; mL milliliter=.001 L; g=gram=.001 kg; kg=kilogram=1000 g.
Necrosis	Localized death of plant tissue - usually characterized by browning and desiccation.
Nematicides	Pesticides which kill small, plant parasitic eelworms called nematodes that live in the soil.
Organophosphates	Insecticides which kill by tying up almost permanently the cholinesterase located between nerves thus interfering with the transfer of messages across nerves.
Photosynthesis	Process by which green plants use sunlight, carbon dioxide and water to produce plant food.
Phytotoxic	Injurious to a plant.
ppb	Parts per billion.
ppm	Parts per million.
Residual herbicide	Persists in soil, kills regrowth and/or germinating seedlings over an extended time.
Soil sterilant	A soil-applied herbicide intended to kill all plant life for an extended time.
Spray drift	Movement of airborne spray droplets beyond the target area.
Surfactant	Adjuvant that improves the emulsifying, dispersing, spreading, wetting, or other properties of a liquid by modifying its surface characteristics.
Synergism	Complementary action of different pesticides such that the total effect is greater than the sum of their independent effects.

Systemic pesticide	One that is able to move in the plant, insect or other organism from the initial point of contact.
Synthetic pyrethroids	Manufactured insecticides which are similar to pyrethrum, a natural insecticide found in chrysanthemums.
Translocation	Process by which substances move within a plant.
Weed control	The prevention or removal of weed growth and/or reduction of infestation for a measurable period of time to a level where it will not compete with the crop or in a non-crop situation where it will not be visible.
Weed suppression	The halting, stopping, or modification of weed growth and/or infestation to a level that will reduce the competition with a crop or in a non-crop situation, to a level that is not considered objectionable. It is generally accepted that weed suppression will be for a shorter term than control.

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AFOLAN F (linuron)
Hoechst

7. FORMULATIONS: Liquid Flowable; 450 g/L; 8 L jug.

8. REGISTERED MIXES: MCPA Amine 500. ***Mix Restrictions:*** Use only MCPA amine to avoid crop injury. Avoid very hard water with MCPA mix. Ensure adequate agitation. Use soon after mixing.

9. CROPS:

Afolan F			**Afolan F+MCPA Amine**
asparagus (8.7)	corn (field, sweet[1])(6.5)	parsnips (7.0)	barley
carrots (8.2)	dill (6.8)	potatoes (8.7)	oats
celery (9.0)	fruit trees[2]	shelterbelts[3] (9.0)	wheat, spring

1=Only on Gold Crest, Marcross, Merit, Preview, Seneca Explorer, Seneca Golden, Seneca 60, Sugar King. 2—apple, cherry, peach, pear, plum, prune-plum. 3—ash (green), caragana, elm (American, Siberian), maple (Manitoba), pine (Scotch), poplar, spruce (Colorado, white), willow.

10. WEEDS CONTROLLED:

Afolan F			
buckwheat, wild (8.5)	groundsel (8.6)	pigweed [prostrate (8.7),	ragweed, common
chickweed, common (9.0)	knotweed	redroot (7.9)]	shepherd's-purse (9.0)
dandelion, seedling (6.0)	kochia (6.4)	plantain, seedling	smartweed, annual (9.0)
foxtail, yellow (6.2)	lamb's-quarters (7.9)	purslane (8.4)	sow-thistle, perennial seedling
goosefoot (8.4)	mustard, wormseed (6.0)	radish, wild	spurry, corn (8.7)
grass, barnyard (8.3)	panicum, fall		stinkweed (8.5)
Afolan F+MCPA Amine			
buckwheat	goat's-beard	mustard (ball, hare's-ear, Indian,	ragweed [common, giant (9.0)]
[Tartary(7.9), wild(7.5)]	hemp-nettle (7.5)	tumble, wild, wormseed)(8.8)	shepherd's-purse
burdock, common	kochia (5.8)	pigweed [prostrate (8.0),	smartweeds, annual (7.0)
chickweed, common (7.4)	lady's-thumb	redroot (7.8), Russian]	stinkweed (8.9)
cockle, cow (6.8)	lamb's-quarters (8.9)	radish, wild	stork's-bill (8.3)
cocklebur	lettuce, prickly		

11. WEEDS SUPPRESSED: Green foxtail, field horsetail.

12. WHEN USED: **Afolan F:** ***Asparagus, potatoes:*** pre-emergent. ***Carrots, parsnips, dill:*** 2 or more leaves; before grassy weeds 5 cm tall, broad leaved weeds 15 cm. ***Celery transplants:*** as soon as new growth starts. ***Corn (field, sweet):*** before corn emerges or as a directed spray on weeds after corn is at least 38 cm tall. ***Fruit trees:*** directed spray around trunk of trees established at least 10 years, peaches 1 year. ***Shelterbelts:*** before or immediately after weeds emerge, before 15 cm tall; no earlier than 10 days after transplanting. After buds open, apply as a directed spray.
Afolan F+MCPA Amine: ***Barley, oats, wheat (spring):*** when crop in 2-4 leaf; weeds in 1-4 leaf. Do not apply after tillering.

13. HOW TO APPLY:
With: Ground equipment.
Rate: Barley, oats, wheat (spring). - Afolan F 200-250 mL/ac + MCPA Amine 445 mL/ac.

	Afolan F (L/ac)			Afolan F (L/ac)	
Crop	**Muck or Clay Medium O.M.**	**Loam or Clay Low O.M.**	**Crop**	**Muck or Clay Medium O.M.**	**Loam or Clay Low O.M.**
Asparagus	2.0	1.5	Corn (pre)	1.6-2.0	1.09-1.6
Carrots, dill, parsnip (pre)	0.81-1.09	0.57-0.81	Corn (post)	1.09-2.0	1.09-2.0
Carrots, dill, parsnip (post)	0.81-2.0	0.81-2.0	Fruit trees	4.0	4.0
Carrots, dill, parnsip (pre+post)	0.57-0.81, then 0.81-1.09		Potatoes (pre)	1.6-2.0	1.09-1.6
Celery (post)	0.81-2.0	0.57-0.81	Shelterbelts	2.0-4.0	2.0-4.0

Application Method: ***Afolan F*** - 40-160 L/ac except on shelterbelts and fruit trees - directed spray required. ***Afolan F+MCPA Amine*** - 40 L/ac water - 275 kPa - 9 km/h. Screens 50 mesh or larger - 80°x flat fan nozzles - adequate agitation required.

14. APPLICATION TIPS: • Early application will avoid crop injury. Barley may suffer growth suppression, maturity delay and yield reduction which may be offset by control of heavy weed growth. • Make only 1 Afolan F application per crop year. • Do not apply to crops under drought, heat or frost stress.

15. HOW IT WORKS: Afolan F: both systemic and contact, absorbed by roots and leaves. MCPA: systemic, absorbed by leaves.

16. EXPECTED RESULTS: First, browning of older leaf tips, then water soaked, wilted appearance, progressive yellowing, stem collapse, browning and death. MCPA promotes stem bending, twisting, leaf cupping. Incorrect timing of application, stress conditions, crusted soil or rain immediately after spraying will cause poor results.

17. EFFECTS OF RAINFALL: Requires rainfall or irrigation for activation of pre-emergent applications. Rainfall within 1 hour may decrease post-emergent effect. Unusually heavy rains after a pre-emergent application may cause severe injury to corn, carrots, or parsnips. ***Afolan F+MCPA Amine*** - rainfall within 4 hours will detract from results.

18. MOVEMENT IN SOIL: Higher rates of Afolan F and extreme moisture may cause some leaching.

19. GRAZING AND CROPPING RESTRICTIONS: Do not graze or feed green plants to livestock. Do not apply within 60 days of harvest. No restriction on succeeding crops except if 2.0 L/ac or more is applied (possible 25% carryover to next season).

20. TOXICITY: Very low mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,500). May irritate eyes, skin, nose and throat. Toxic to fish.

21. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical aid in all cases.

22. STORAGE: Do not store below 5°C. If stored for 1 year or longer, shake well before using.
NOTE: A similar product, Lorox L, is listed on page 66.

AMIBEN (chloramben)

Union Carbide

1. FORMULATIONS: Granular - Amiben Granular; 10%; 22.7 kg bag. - Amiben DS; 75%; 5.4 kg bag. Solution; Amiben; 240 g/L; 20 L pail.
2. REGISTERED MIXES: Eptam, Eptam+Treflan, Treflan.
3. CROPS: Asparagus (8.4); beans [lima, red kidney, snap, white (dry)(9.0)]; carrots, potatoes (white only); peppers, pumpkins, squash, sunflowers, tomatoes. Amiben+Treflan - sunflowers (9.0). ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED:

barnyard grass (7.5)	foxtail [green (6.1), yellow (5.1)]	pigweed	smartweed (7.9)
chickweed, common (9.0)	lamb's-quarters (6.7)	[redroot, prostrate (6.2)]	
dock, curled	mustard, wild (8.3)	ragweed, common	

5. WEEDS SUPPRESSED: None
6. WHEN USED: Pre-plant incorporated or post-plant pre-emergent.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate:

Crop	Amiben (L/ac)	Amiben DS (kg/ac)	Amiben Granular (kg/ac)
Asparagus	3.7-5.7	1.2-1.8	9.1-13.1
Beans	3.7-5.7	1.2-1.8	lima only 13.1
Carrots	-	-	13.1-18.2
Peppers, tomatoes.	-	-	18.2
Potatoes	-	-	9.1-18.2
Pumpkins, squash.	3.7-5.7	1.2-1.8	9.1
Sunflowers	3.7-5.7	-	-

   Sunflowers - 3.7 L/ac Amiben + 1.1 L/ac Treflan on loam to clay soils or 800 mL/ac Treflan on sandy soils.
   Water Volume: 40-80 L/ac
   Incorporation: Not required for vegetable crops. Thoroughly incorporate within 8 hours into the soil in 2 directions at right angles to each other for sunflowers. Set implements to cut 8.0-10.0 cm deep.
   Pressure: 275 kPa
   Ground Speed: Operate disc implements at 6-10 km/h, cultivators 10-13 km/h.
8. APPLICATION TIPS: • For proper incorporation follow Treflan label. • Seed sunflowers within 1 week of application. • A light cultivation with a vegetable crop will increase weed control when there is inadequate moisture to move the Amiben down but enough moisture to germinate the weeds.
9. HOW IT WORKS: Requires moisture for activation, it inhibits root development of seedling weeds for several weeks.
10. EXPECTED RESULTS: ***Wild Mustard:*** Affected seedlings will not emerge from the ground. Control of cruciferous species will last for at least 6-8 weeks following treatment. ***Poor results may be expected if:*** • Application and incorporation when soil surface is wet. • Inadequate soil incorporation or the use of improper incorporation equipment. • Insufficient moisture to carry the chemical into the soil.
11. EFFECTS OF RAINFALL: In light soils a heavy rainfall may wash Amiben below the root zone of germinating weed seeds.
12. MOVEMENT IN SOIL: Water soluble.
13. GRAZING AND CROPPING RESTRICTIONS: None.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{∞} rats (mg/kg) = technical (3,500). May be a skin irritant. Non-toxic to fish and birds.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in heated area. If freezing occurs store in a warm room at 10-27°C for several hours and agitate thoroughly before using to ensure all crystals are dissolved.

AMITROL-T (amitrole)
Union Carbide

1. FORMULATIONS: Liquid; 200 g/L; 1 L, 10 L containers.
2. REGISTERED MIXES: None.
3. CROPS: Non-crop areas (fence rows, ditchbanks, roadsides), pastures, shelterbelts. Pre-plant - corn, beans (white). Post-harvest - grain, peas. After final cutting - alfalfa, asparagus, clover.
4. WEEDS CONTROLLED:

cattails	milkweed, showy	sow-thistle (annual, perennial)	toadflax
cress, hoary	poison-ivy	spurge, leafy	most annual weeds
horsetail, field	quackgrass	thistle, Canada	

5. WEEDS SUPPRESSED: None.
6. WHEN USED: ***Alfalfa, asparagus, clover:*** after final cutting, NOT after October 1. ***Corn, beans (white):*** pre-planting. ***Crops:*** non-selective, spot treatment. ***Grain, peas:*** post-harvest, NOT after October 1. ***Shelterbelts:*** in established plantings only. ***Cattails:*** after catkins are fully formed up to frost. ***Cress (hoary), spurge (leafy):*** during advanced rosette and bud stages. ***Horsetail:*** during vigorous growth. ***Milkweed:*** early summer when all shoots have emerged. ***Poison-ivy:*** after foliage is fully developed until plants begin to turn color in fall. ***Quackgrass:*** 15-20 cm tall. ***Thistles:*** early bud to bloom. ***Toadflax:*** advanced rosette to prebud.
7. HOW TO APPLY:
   With: Ground equipment, hand sprayer.
   Rate: ***Non-crop areas*** - Poison-ivy 4.5 L/ac; Cress, milkweed, quackgrass, toadflax, thistles 9-14 L/ac; Cattails, spurge 18-22 L/ac. ***Crop areas*** - Corn (pre-plant) - annual weeds, quackgrass 5.25 L/ac; Corn, beans (pre-plant) - quackgrass, Canada thistle 6.9-8.9 L/ac; Alfalfa + clover (after final cut), grain + peas (post-harvest) 8.9-10 L/ac; Asparagus (after final cut) 8.9 L/ac. ***Shelterbelts*** - 8.9-14 L/ac. ***Spot treatment of regrowth*** - 1/2 of the original rate.
   Water Volume: Non-crop areas - 405 L/ac minimum. Crop areas - 80-200 L/ac; Asparagus - 405-810 L/ac; Shelterbelts - 405 L/ac.
   Pressure: 150-275 kPa.
8. APPLICATION TIPS: • Spray to point of run-off, complete coverage of weeds essential. Under or around desirable plants or trees; avoid contact with foliage, green stems, or fruit as severe injury or destruction may result. Use a hooded sprayer if necessary. • Do not disturb or mow treated plants for at least 2 weeks after treatment. If practical, till 2-3 weeks after treatment. If no tillage is possible, then spot treat weed regrowth with 1/2 original rate. • Do not apply where water will be used for irrigating, drinking, or other domestic use. • Do not spray near sparks or open flame.
9. HOW IT WORKS: Systemic herbicide which inhibits chlorophyll production. Moves through foliar and root system.
10. EXPECTED RESULTS: Whitening begins in 7-14 days and plants die. Short term residual. ***Poor results may be expected if:*** poor coverage, inadequate rate, plants over mature or under drought stress. Tillage too soon after application.
11. EFFECTS OF RAINFALL: Heavy rain within 6-8 hours reduces effectiveness.
12. MOVEMENT IN SOIL: At recommended rates - persists in soil 4-8 weeks.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze treated alfalfa or clover for 8 months. Do not graze other treated areas for 6 months. Most crops susceptible to drift. ***Succeeding Crops:*** After post-harvest treatment of grain, peas, alfalfa, or clover do not plant to crop for 8 months.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (24,600). May be irritating to skin and eyes; has potential to cause health problems after prolonged, continuous exposure. Non-toxic to fish and birds.
15. PRECAUTIONS, FIRST AID: Do not apply on foraging bees. Do not spray near sparks or open flame. Wear standard protective clothing (see page 4) to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Do not freeze or store above 30°C. No shelf life limitation. If frozen, contents will crystallize - to resuspend warm to 27°C and agitate as necessary.

AMIZINE (amitrole + simazine)

Union Carbide

1. FORMULATIONS: Liquid; 53 + 106 g/L; 10 jug.
2. REGISTERED MIXES: None. Mix Restrictions: See "Soil Sterilants" page 3.
3. CROPS: Industrial sites and non-cropped areas only.
4. WEEDS CONTROLLED: All broad-leaved weeds and grasses. Some of the weeds controlled are listed.

bluegrass	lamb's-quarters	plantain	smartweed
dandelion	nightshade	purslane	sow-thistle
foxtail (green, yellow)	oats, wild	quackgrass	
kochia	pigweed	ragweed	

5. WEEDS SUPPRESSED: Not applicable.
6. WHEN USED: Apply in spring or early summer before weeds are 8-10 cm tall. On larger weeds, cut or mow them to ground line and remove. Treat 1 or 2 weeks later when regrowth appears.
7. HOW TO APPLY:
   With: High volume ground sprayer - hand sprayer.
   Rate: Ground sprayer - 34.5 L/ac. - hand sprayer 800 mL/100 m^2
   Water Volume: 500 L/ac - hand sprayer 8-12 L/100 m^2
   Pressure: 275 kPa
   Nozzles: TeeJet 8002 or larger fan nozzles.
8. APPLICATION TIPS: Use no finer than 50 mesh size screens.
9. HOW IT WORKS: Absorbed by roots and moves through plant. Affects chlorophyll - plant whitens and dies slowly. Simazine remains in soil giving control for 1 growing season.
10. EXPECTED RESULTS: Plants turn white in 7-14 days and are usually dead in 3 weeks. Area should remain weed free for 1 season.
11. EFFECTS OF RAINFALL: Rainfall will carry chemical into root zone and speed action.
12. MOVEMENT IN SOIL: Adsorbed on soil particles and resists leaching by rainfall.
13. GRAZING AND CROPPING RESTRICTIONS: not applicable. Lilac, privet, honeysuckle, barberry are very susceptible to drift.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (4,000). Has potential to cause health problems after prolonged, continuous exposure or may cause dermatitis. Non-toxic to fish and birds. May be toxic to bees.
15. PRECAUTIONS, FIRST AID: Do not apply when bees are foraging. Wear standard protective clothing (see page 4) to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Do not freeze to avoid crystallization. If frozen, warm and agitate until crystals redissolve.

ASULOX F (asulam)
May & Baker

1. FORMULATIONS: Solution; 400 g/L; 20 L pack.
2. REGISTERED MIXES: Buctril M, Embutox. ***Mix Restrictions:*** Add the required amount of Buctril M and mix, then add Asulox F.
3. CROPS: Flax (8.3), seedling and established alfalfa, grown for seed (8.3). ***Underseeding:*** Flax underseeded to alfalfa.
4. WEEDS CONTROLLED: Wild oats (7.8).
5. WEEDS SUPPRESSED:

barley, volunteer (3.3)	buckwheat, wild (5.3)	mustard, wild (8.0)	stinkweed (8.6)
barnyard grass	foxtail, green (6.3)	oats, volunteer (6.7)	wheat (3.0)
bluebur	lady's-thumb	smartweed, annual (7.1)	

6. WHEN USED: 2-4 leaf stage of wild oats when flax 2.5-15 cm tall. Alfalfa when beyond first trifoliate leaf stage.
7. HOW TO APPLY:
   With: Ground equipment. Floaters not recommended.
   Rate: 1.1 L/ac
   Water Volume: 20-40 L/ac
   Pressure: 275 kPa
   Nozzles: Flat fan recommended.
8. APPLICATION TIPS: • Do not spray unthrifty crops or flax under stress due to drought or excess soil moisture.
   • Do NOT spray in hot, humid weather conditions or when crop is wet with dew.
   • Flax will likely sustain injury if grown on low fertility soils.
9. HOW IT WORKS: Absorbed by leaves and translocated; inhibits cell division in the growing points of the plant. Symptoms are severe yellowing of new leaves, stunting and finally death. Growing points are killed within 1-2 weeks but full effect occurs by the fourth week.
10. EXPECTED RESULTS: ***Wild oats:*** Start to yellow about 1 week after application. Wild oat plants not at the recommended growth stage or those that emerge after spraying will be unaffected. ***Crop:*** Temporary slight yellowing of the flax leaves may occur a few days after spraying. Crop recovery from wild oat competition may be slow if the weeds have been allowed to smother the flax. Stunting and delay in maturity may be noticed. ***Poor results may be expected:*** with incorrect spray volume or ground speed; improper stage of wild oats; spraying when foliage is wet with dew; spraying when flax is under stress or in hot, humid weather.
11. EFFECTS OF RAINFALL: Rainfall within 8 hours may seriously affect activity.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Danger from drift is low, but cereals may be slightly yellowed. ***Grazing Restrictions:*** Do not graze or feed crop.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,000). Non-toxic to birds, fish and bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to prevent contact with skin and eyes. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Heated storage. If frozen, redissolve crystals by storing in a warm room and thorough agitation.

ATRAZINE

Ciba-Geigy / Chipman

1. FORMULATIONS: Liquid; ***Aatrex Liquid*** (Ciba-Geigy); 480 g/L; 10 L jug. Granular; ***Aatrex Nine-O*** (Ciba-Geigy); 90 %; 4.5, kg bag. Flowable; ***Aatrex Plus*** (Ciba-Geigy); 400 g/L + 25% oil concentrate; 10 L pail. Flowable; ***Atra-Mix*** (Chipman); 400 g/L + 25% oil concentrate; 2 x 10 L pack. Flowable; ***Atrazine F*** (Chipman); 500 g/L; 2 x 10 L pack. Wettable Powder; ***Atrazine 90W*** (Chipman); 90%; 10 x 2 kg pack.

2. REGISTERED MIXES: ***Aatrex Plus, Atra-Mix*** - none. ***Aatrex Nine-O, Aatrex Liquid*** - corn oil concentrate, nitrogen solutions or complete liquid fertilizers, Dual Ciba-Geigy 960E, Bladex, Sutan$^+$. ***Atrazine F, Atrazine 90W*** - superior oil concentrate, fertilizers, Bladex, Sutan$^+$. ***Mixing Restrictions:*** Do not mix oil concentrates, surfactants or hormone type herbicides with any mixture of Atrazine plus Bladex. Tank Mixes: add water, then Atrazine, agitate, add Bladex slowly, agitate thoroughly.

3. CROPS: All corn.

4. WEEDS CONTROLLED:

Atrazine

buckwheat, wild	lamb's-quarters	oats, wild	
clover, volunteer	mustards	pigweed, redroot	
grass, barnyard	purslane	smartweeds, annual	
lady's-thumb	ragweed	foxtail (green, yellow)*	

NOTE: *post-emergent

Atrazine + Dual Ciba-Geigy
foxtail (green, yellow)

Atrazine + Sutan$^+$
foxtail (green, yellow)

5. WEEDS SUPPRESSED: None.

6. WHEN USED: ***Aatrex Nine-O, Aatrex Liquid, Atrazine F, Atrazine 90W*** - pre-plant, pre-emergent, post-emergent or band applied. ***Aatrex Plus, Atra Mix*** - mainly post-emergent but may be used pre-emergent, after planting corn.

7. HOW TO APPLY:
With: Ground equipment.
Rate: ***Aatrex Liquid*** - 1.3-2.7 L/ac. ***Aatrex Liquid*** 1.3-1.8 L/ac + 6.9 L/ac emulsified oil in 60-120 L/ac of water. ***Aatrex Nine-O, Atrazine 90W*** - 0.8-1.5 kg/ac. ***Aatrex Plus*** - 1.7 L/ac. ***Atrazine F*** - 1.3-2.84 L/ac. ***Atrazine F*** - 1.3-1.9 L/ac + 6.9 L/ac superior oil in 80-120 L/ac of water. ***Atra-Mix*** - 1.8 L/ac on light, sandy soil; 2.3 L/ac on loam or clay; 3.4 L/ac on high organic soils. **NOTE:** Vary rates according to different soil types. ***Quackgrass Control:*** Atra-Mix, Aatrex Plus - 2.2 L/ac to quackgrass foliage in fall or early spring. Cultivate 1-3 weeks later, plant corn. Repeat chemical treatment as early post-emergent.
Water Volume: 60-120 L/ac.
Incorporation: Only ***Aatrex Liquid, Atrazine F, Atrazine 90W, Aatrex Nine-O*** are applied pre-plant; ***Aatrex Plus, Atra Mix*** can be applied as pre-emergent. Do not incorporate deeper than 5.0 cm.
Pressure: 200-300 kPa

8. APPLICATION TIPS: • Continuous gentle agitation is needed. Avoid excessive agitation, especially with oil mixtures, as a grease like mass may form. • Use oil mixes at once and clean tank and system with a strong detergent solution. • Use 50 mesh or larger strainers and use only metal filters. • Bypass line should discharge to bottom of tank. • Band treatments are desirable when cultivation is to alleviate hard soil conditions or to control annual weeds.

9. HOW IT WORKS: Inhibits photosynthesis.

10. EXPECTED RESULTS: Weeds slow to emerge or under drought conditions will be killed when moisture improves. Heavy rainfall on sandy soils may cause leaching, a decrease in efficacy and off target injury.

11. EFFECT OF RAINFALL: Rainfall will activate the chemical, carrying it into the root zone where kill will begin.

12. MOVEMENT IN SOIL: Heavy rainfall on sandy soils may cause leaching and soil movement.

13. GRAZING AND CROPPING RESTRICTIONS: Plant only to corn in year of treatment. Sugar beets should not be planted for 2 years following the growing season in which Atrazine is used. Crops most tolerant, next to corn, are sorghum then flax, fababeans and peas. Latter crops may be seeded in the season following application if rates were not greater than 40 g/ac of active Atrazine. Crop injury to succeeding crops may occur if there is an extended period of dry weather during year of treatment. Injury is most likely to occur on seedling crops subjected to periods of stress such as hot, dry weather. ***To reduce Atrazine residues:*** Thorough tillage, including ploughing should precede planting of crops other than corn. Uneven application or application in excess of recommended rates will not injure corn but may result in injury to other succeeding crops.

14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,080). May cause eye irritation. Very low toxicity to fish and birds.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF AATREX PLUS or ATRA-MIX SWALLOWED - do NOT induce vomiting. Get medical attention. IF AATREX LIQUID, AATREX 90W, AATREX NINE-O or AATREX 80W SWALLOWED - induce vomiting (see page 6). Get medical attention.

16. STORAGE: The flowable formulations should be kept from freezing. If stored in unheated areas the product should be warmed and agitated thoroughly prior to using.

AVADEX BW (triallate)

Monsanto

WARNING POISON

1. FORMULATIONS: Emulsifiable Concentrate; Avadex BW Liquid; 400 g/L; 22.7 L pail. Granular; Avadex BW Granular; 10%; 22.7 kg bags.

2. REGISTERED MIXES: Rival, Treflan, dry bulk or liquid fertilizers. ***Mixing Instructions:*** Thorough mixing is is essential. Agitation is required to suspend mixture, or to resuspend if spray mixture is allowed to settle at anytime. ***Mixing Restrictions:*** Do not mix with nitrate fertilizers, they may cause explosions and fires.

3. CROPS: Barley (8.9), flax (8.9), mustard (9.0), peas (field)(9.0), rapeseed (8.2), sugar beets, wheat (8.3)(durum, spring) ***Underseeding:*** Alfalfa, bird's-foot trefoil, clovers; provided they are not harvested for green feed, silage or hay in year of seeding.

4. WEEDS CONTROLLED: Wild oats (7.6)

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***Spring:*** Pre-plant incorporated on flax, mustard, peas, rapeseed, sugar beets. Pre-plant and post-plant incorporated on barley and wheat. Do not apply pre-plant with wheat in soils with 4% or less organic matter where discers are to be used for the seeding operation. Seed to the proper depth immediately or up to 3 weeks after application. ***Fall:*** All crops. Granules: September 15 to freeze-up. Liquid: October 1 to freeze-up.
NOTE: Fall application is not recommended where erosion may be a problem.

7. HOW TO APPLY:
With: Aircraft (granules only) or Ground equipment.
Rate:
(A) Spring Application

Crops	Application Timing	Organic Matter 4% or Less		Greater than 4%	
		Liquid L/ac	Granules kg/ac	Liquid L/ac	Granules kg/ac
Barley	Before and after seeding	1.4	5.7	1.7	6.9
Flax, mustard, rapeseed, sugar beets.	Before seeding	1.7	6.9	2.2	8.9
Peas (dry)	Before seeding	1.7	-	1.7	-
Wheat (durum, spring)	Before seeding	1.2	4.4	1.4	5.7
	After seeding	1.4	5.7	1.7	6.9

(B) Fall Application **NOTE:** ***Not recommended where soil erosion is a problem.***

Crops	Organic Matter Less than 2%		2-4%		Greater than 4%	
	Liquid L/ac	Granules kg/ac	Liquid L/ac	Granules kg/ac	Liquid L/ac	Granules kg/ac
Barley	1.2	4.4	1.4	5.7	1.7	6.9
Flax, mustard, rapeseed, sugar beets.	1.4	5.7	1.7	6.9	2.2	8.9
Wheat (durum, spring)	1.2	4.4	1.4	5.7	1.7	6.9

Water Volume: Liquid formulation only - 36 L/ac minimum.
Incorporation: ***AVADEX BW*** - Two incorporations at right angles are required for thorough mixing. On stubble, incorporate with double disc or cultivator followed by harrowing at right angles. On fallow, use 2 harrowings at right angles if the soil is loose and free of trash and lumps. Do not incorporate into wet soil. ***Liquid***: the first incorporation should be completed as soon as possible on the day of spraying. ***Granules***: the first incorporation should be completed within 48 hours of application. The second incorporation for both liquid and granules may or may not be done immediately after the first. For maximum results from spring application of granules, delay second incorporation for at least 3-5 days. ***AVADEX BW + UREA - Spring:*** all crops. Only pre-plant incorporated applications recommended. Incorporate immediately after spreading. For best results delay second incorporation for at least 3-5 days. ***Fall:*** Applications should be followed immediately by a shallow discing or cultivation. In the spring prior to seeding, a shallow cultivation at right angles to the fall operation is recommended.
Implements: Operate incorporation equipment at 9 km/h. • Use a double disc or light cultivator, to a depth of 7.5 cm, plus harrows for pre-plant incorporation. Heavy duty harrows must be used for post-plant incorporation. • Straw, lumps of soil, etc. dragged by harrows will cause uneven incorporation resulting in reduced wild oat control.
Pressure: Liquid formulation only - 200 kPa.

8. APPLICATION TIPS: ***Choice of Formulation*** - Use liquid formulation on soils free of trash. Use granules (fall application best) on all soils including those with heavy trash cover. Granules may be applied in the fall prior to or in conjunction with fertilizer banding. ***Field Preparation*** - Make sure the soil is in good working condition. Reduce trash to an acceptable level before application. If soil is excessively wet or lumpy, cultivate with suitable equipment to improve soil condition. ***Seeding*** - Flax, mustard, and rapeseed can be seeded in treated layer. Barley and wheat are more sensitive and should be planted 6.0-7.5 cm. Wheat must be seeded below the treated layer. • Drought conditions in the year of treatment may result in higher levels of Treflan/Rival carryover. To avoid wheat injury, seed 6.0-7.5 cm into warm, moist seedbed. • After seeding, any deep ridges left by drills must be levelled by harrowing.

9. HOW IT WORKS: Absorbed by wild oat shoots, usually resulting in death before emergence. Under dry conditions wild oats may emerge before being killed.

10. EXPECTED RESULTS: ***Wild oats:*** Usually kills wild oats before they emerge. Scraping away the soil 1-2 weeks following treatment will expose white to yellow wild oats shoots 2.0-2.5 cm in length with pinched tips. Plants which have emerged and absorbed a lethal dose will cease growth, leaves become brittle and bluish-green in colour. Under dry conditions, a rainfall of 1.5 cm or more when wild oats are emerging, can cause post-emergent die-back of a high percentage of wild oat plants. ***Crop:*** Wheat seeded into the treatment zone under very dry soil conditions may be thinned and delayed when germinating and emerging just prior to a heavy rainfall. Wheat must be seeded at least 1.5 cm below the treated layer of soil (eg. 5-7.5 cm). Some wheat thinning may be noted on eroded knolls. ***Poor results may be expected if:*** Incomplete incorporation due to wet, cloddy soil, or heavy trash. Incorporation delayed, very dry soil conditions, in spring or prolonged cool soil temperatures at time of germination. Ridges left by seeding may disrupt the treated layer and allow escapes. Equipment deficiencies such as very light harrows.

11. EFFECTS OF RAINFALL: Moisture is required for activation. Rainfall of at least 1.5 cm within 2 weeks of application, in the spring, is required to ensure maximum performance.

12. MOVEMENT IN SOIL: Negligible

13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** No effect on standing crops. ***Grazing Restrictions:*** None. ***Crop Use After Hail:*** No restrictions. ***Succeeding Crops:*** Oats should not be seeded into soil treated with Avadex BW in the previous year.

14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,675-2,165). May cause slight eye irritation. Slightly toxic to fish. Non-toxic to birds.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid getting chemical on skin or in the eyes. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Store above 0°C. If frozen, warm to 22°C and agitate to redissolve crystals.

AVENGE 200-C/640 (difenzoquat)

Cyanamid

1. FORMULATIONS: Liquid; Avenge 200-C; 200 g/L; 20 L pail. Soluble Powder; Avenge 640; 640 g cation/kg; 20 kg pail.

2. REGISTERED MIXES: bromoxynil* (Pardner, Torch DS); bromoxynil+MCPA ester (Brominal M, Bromox, Buctril M, Pardner+MCPA ester, Sabre, Torch DS+MCPA ester); Estaprop (only barley and wheat, NOT underseeded legumes); Glean*; MCPA ester; 2,4-D ester* (only barley, wheat) 2,4-DB* (Embutox; Cobutox 400; 2,4-D Butyric).
*=NOT on canary grass. ***Mix Instructions:*** Add 1/2-3/4 required amount of water; start agitating, as broad-leaved herbicide, then rest of water, then Avenge. Ensure Glean is thoroughly dissolved before adding Avenge. Do NOT add surfactant to Avenge 200-C+Glean. Avenge 640 alone or in mix requires surfactant (Agral 90 or Ag-Surf). If foaming is a problem, add a silicone anti-foaming agent. ***Mix Restrictions:*** Do NOT mix with MCPA amine; dicamba (Banvel) or Target; or 2,4-D amine.

3. CROPS: ***Barley:*** all varieties. ***Canary Grass. Fall Rye:*** Cougar, Frontier, Kodiak, Puma, Rymin. ***Spring Wheat:*** Benito, Canuck, Chester, Columbus, Fielder, Glenlea, HY320, Katepwa, Leader, Macoun, Neepawa, Selkirk. ***Triticale:*** Carman, Welsh. ***Winter Wheat:*** Norstar, Sundance. ***Forages Underseeded to Wheat or Barley:*** Alfalfa, bird's-foot trefoil, bromegrass, clover (red, sweet), crested wheatgrass, fescue (creeping red, red, meadow), Kentucky bluegrass, orchard grass, reed canary grass, Russian wild rye grass, timothy.

4. WEEDS CONTROLLED: Wild oats (7.5)

5. WEEDS SUPPRESSED: None

6. WHEN USED: 3-4 leaf stage to minimize early wild oat competition, and maximize yield increases. Very good control at 4-5 leaf stage but yield increases may be reduced. Do not apply to barley, wheat or canary seed after 6 leaf stage of crop. Do not use Avenge+Glean in the brown soil zone. Use Avenge+Glean on soils with a pH of 7.5 or lower.

7. HOW TO APPLY:
With: Aircraft or Ground equipment. Do not apply Avenge+Glean by air.
Rate:

	Air		Ground	
Infestation Level	**200-C**	**640+(Agral 90/Ag-Surf)**	**200-C**	**640+(Agral 90/Ag-Surf)**
1-200 wild oat plants/m²	1.4 L/ac	445 g/ac+(50-120) mL/ac	1.4 L/ac	445 g/ac+(245) mL/ac
Over 200 wild oat plants/m²	1.7 L/ac	525 g/ac+(50-120) mL/ac	1.7 L/ac	525 g/ac+(245) mL/ac

For registered mixes use recommended rate of Avenge and label recommended rate of other herbicide. Use up to 0.45 L/ac of MCPA ester or 0.55 L/ac 2,4-D ester 600.
Water Volume: ***Avenge 200-C:*** Air - 8 L/ac minimum; Ground - 40 L/ac; Spra-Coupe - 40 L/ac.
Avenge 640: Air - 8-20 L/ac; Ground - 40 L/ac.
Incorporation: Not applicable
Pressure: 275 kPa
Nozzles: Flat fan recommended; tilted 45° forward for better spray penetration. 50 mesh metal screens and filters.

8. APPLICATION TIPS: • Do not spray if crop is heavy with dew or rain. • Do not apply if the crop is stressed from extreme drought or excessive moisture. • Do not spray if freezing temperatures are forecast. • Follow Glean label when tank mixing.

9. HOW IT WORKS: Acts on the growing point located at or just above the soil surface and placing herbicide at or below this point is most efficient. It distrupts cell division and elongation causing growth to stop. Works best at high temperature and humidity.

10. EXPECTED RESULTS: ***Wild Oats:*** Start to yellow within 3-5 days after application. Effect will be faster when temperature and humidity are high. Affected plants will turn brown or remain stunted and partially green throughout the season. Wild oats in the 1-2 leaf stage at spraying or those that emerge after spraying will be unaffected. ***Crop:*** A slight yellowing of the crop may be visible 5-7 days after application and will remain visible for 2 weeks. ***Poor results may be expected if:*** Spraying before 3 leaf stage; too low a rate for the wild oat population; inadequate coverage due to dense broad-leaved weed population; drought or temperature stress.

11. EFFECTS OF RAINFALL: Rainfall within 6 hours will seriously decrease activity.

12. MOVEMENT IN SOIL: Not applicable.

13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Only oats can be seriously affected by drift. ***Grazing Restrictions:*** Do not graze or feed crop for 8 weeks after treatment. Treated underseeded forages should not be grazed or harvested for feed during the year of seeding. ***Crop Use After Hail:*** Do not use for 8 weeks after treatment.

14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (506-691). Non-toxic to fish, birds or bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles to prevent contact with skin and eyes. ***Symptoms of poisoning:*** headaches, tiredness and diarrhea. No long term health problems noted. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical aid in all cases.

16. STORAGE: Will withstand freezing temperatures, returning to full solution as temperature increases.

BANVEL (dicamba)

Sandoz Agro

CAUTION POISON

1. FORMULATIONS: Solution; 400 g/L; 10 L jug. Solution 480 g/L; 5 L, 9.5 L jug. **Please know which formulation you have before using the rates outlined in "How to Apply".**

2. REGISTERED MIXES: Lexone or Sencor (metribuzin); MCPA Amine; MCPA K-Salt; Roundup; 2,4-D (Amine, LV Ester).

3. CROPS:

barley (8.2)	grass, canary	oats (8.6)	reduced tillage
corn, field	grasses (established turf,	rye, spring	non-crop areas
fescue, red (seed crops)	pasture, rangeland)	wheat (durum, spring,	stubble
		winter)(8.2)	summerfallow

4. WEEDS CONTROLLED:

Banvel Alone (Crop rates) Banvel tank mixes control these weeds + those controlled by the other herbicide.

buckwheat	cleavers*(6.4)	lady's-thumb	spurry, corn (6.0)
[Tartary(6.7), wild(7.9)]	cockle, cow (7.0)	smartweeds, annual (6.4)	

Banvel Alone (Pasture, Rangeland, Non-crop areas; 2 rates)

Lower rate		***Higher rate***	
bindweed, field	ragwort*, tansy	cherry, ground	poverty weed
daisy, English	sow-thistle, perennial	goat's-beard	sage, pasture
goldenrod	thistle, Canada	knapweed, diffuse	sorrel, sheep
			spurge, thyme-leaved

Banvel+Roundup (Reduced Tillage)

buckwheat, wild*	foxtail, green	lady's-thumb	rapeseed, volunteer
cereals, volunteer	kochia	lamb's-quarters	stinkweed
cockle, cow		mustard, wild	thistle, Russian
flixweed*		oats, wild	

Banvel+2,4-D (Brush)

alder	poplar, aspen	snowberry, western	willow, wolf
cherry	rose, wild		

* Suppression or control dependent on rates used.

5. WEEDS SUPPRESSED: Control top growth of Canada thistle, and perennial sow-thistle at in-crop rates. Top growth control of curled dock at lower pasture rate. Banvel+Roundup suppresses red root pigweed and foxtail barley.

6. WHEN USED: ***Recommended Leaf Stage or Height of Crop:***

Crop	Banvel Alone	Banvel+2,4-D Amine-500	Banvel+MCPA Amine-500	Banvel+MCPA K-400	Banvel+ Metribuzin
Barley	2-5	2-5	2-5	2-5	2-3
Canary grass	3-5	-	3-5	-	-
Corn (post emergence)	up to 20 cm	up to 10 cm	-	-	-
Corn (drop nozzles)	20-50 cm	10-50 cm	-	-	-
Fescue (red) seedling	5 cm tall	5 cm tall	-	-	-
Fescue (red) established	up to flag leaf	up to flag leaf	-	-	-
Oats	2-5	-	2-5	2-5	-
Rye (spring)	2-3	2-3	-	-	-
Wheat (spring, durum)	2-5	2-5	2-5	2-5	2-3 (spring wheat only)
Wheat (winter)	15-25 cm	15-25 cm	15-25 cm	15-25 cm	-

Summerfallow: Banvel alone, cultivate in spring. Apply before thistles reach early bud stage (15-25 cm tall); when field bindweed is flowering. Banvel+Roundup+non-ionic surfactant, for Canada thistle or perennial sow-thistle only. Tillage and timing practices same as Banvel alone. ***Stubble:*** Banvel alone or Banvel+Roundup+non-ionic surfactant, Apply to thistle regrowth when 10-15 cm tall. Apply 2 weeks prior to first killing frost. ***Pastures, Rangeland Grasses:*** Apply when weeds are actively growing or when brush species are under 2 m tall. ***Reduced Tillage for annual weeds, summerfallow:*** apply Banvel+Roundup+non-ionic surfactant to actively growing weeds from 8-15 cm tall. ***Cleavers:*** better control may be obtained by spraying before 3 whorl stage.

7. HOW TO APPLY:

With: Aircraft or Ground equipment.

Rate: ***Air*** - (Banvel or Banvel+phenoxy mixes only). Apply only 110 mL/ac (400 g/L) or 95 mL/ac (480 g/L) of Banvel by air. ***Ground equipment*** - see tables for 400 g/L and 480 g/L.

Water Volume: Air- 8 L/ac minimum. Ground - Cereals, seed grasses: 45 L/ac. Corn: 90-140 L/ac. Summerfallow/stubble (thistles): 45-90 L/ac. Reduced Tillage: 20-40 L/ac. Pastures, Rangeland Grasses: 45-90 L/ac.

Pressure: Air - not above 200 kPa. Ground - 275 kPa.

Nozzles: Flat fan recommended.

BANVEL 400 g/L FORMULATION

Crop	Banvel Alone mL/ac	Banvel+2,4-D Amine-500 mL/ac+mL/ac	Banvel+MCPA Amine-500 mL/ac+mL/ac	Banvel+MCPA K-400 mL/ac+mL/ac	Banvel+Metribuzin (Sencor OR Lexone DF) mL/ac+mL/ac OR g/ac
Barley	110	110+340	110+340	110+445	110+110-170 mL OR 110 g
Canary grass	140	-	140+340	-	-
Corn (field)	285	140+340	-	-	-
Fescue (red)	285	285+600	-	-	-
Oats	110-140	-	110-140+340	110-140+445	-
Rye (spring)	110-140	110-140+340	-	-	-
Wheat (durum, spring)	110-140	110-140+340	110-140+340	110-140+445	110+110-170 mL OR 110 g
Wheat (winter)	110-140	110-140+340	110-140+340	110-140+445	-

Other Uses	Banvel Alone L/ac	Banvel+2,4-D Amine-500 rate/ac	Banvel+2,4-D L.V. Ester-600 rate/ac	Banvel+Roundup+ non-ionic surfactant mL/ac+mL/ac+mL/ac
Summerfallow/ Stubble - thistles	1.2 L	-	-	610+690+142
Reduced tillage	-	-	-	140-280+305-400+142
Pastures, Rangeland Grasses				
Weed control	1.0-2.2 L	1.0 L+0.9 L	1.0 L+0.75 L	-
Brush control	-	2.5 L+4.0 L in 1000 L water	2.5 L+3.3 L in 1000 L water	-

BANVEL 480 g/L FORMULATION

Crop	Banvel Alone mL/ac	Banvel+2,4-D Amine-500 mL/ac+mL/ac	Banvel+MCPA Amine-500 mL/ac+mL/ac	Banvel+MCPA K-400 mL/ac+mL/ac	Banvel+Metribuzin (Sencor OR Lexone DF) mL/ac+mL/ac OR g/ac
Barley	95	95+340	95+340	95+445	95+110-170 mL OR 110 g
Canary grass	115	-	115+340	-	-
Corn (field)	245	115+340	-	-	-
Fescue (red)	245	245+600	-	-	-
Oats	95-115	-	95-115+340	95-115+445	-
Rye (spring)	95-115	95-115+340	-	-	-
Wheat (durum, spring)	95-115	95-115+340	95-115+340	95-115+445	95+110-170 mL OR 110 g
Wheat (winter)	95-115	95-115+340	95-115+340	95-115+445	-

Other Uses	Banvel Alone L/ac	Banvel+2,4-D Amine-500 rate/ac	Banvel+2,4-D L.V. Ester-600 rate/ac	Banvel+Roundup+ non-ionic surfactant mL/ac+mL/ac+mL/ac
Summerfallow/ Stubble - thistles	1.0 L	-	-	510+690+142
Reduced tillage	-	-	-	115-245+305-400+142
Pastures, Rangeland Grasses				
Weed control	0.85-1.9 L	0.85 L+0.90 L	0.85 L+0.75 L	-
Brush control	-	2.1 L+4.0 L in 1000 L water	2.1 L+3.3 L in 1000 L water	-

Broadcast ground application of Banvel+2,4-D in 90-130 L/ac of water as follows:

Brush Species	400 g/L Formulation	480 g/L Formulation
Aspen poplar	1.5 L/ac+1.7 L/ac 2,4-D Amine-500 OR 1.5 L/ac 2,4-D Ester-600.	1.3 L/ac+1.7 L/ac 2,4-D Amine-500 OR 1.5 L/ac 2,4-D Ester-600.
Wild rose	1.7 L/ac+1.7 L/ac 2,4-D Amine-500 OR 1.5 L/ac 2,4-D Ester-600	1.5 L/ac+1.7 L/ac 2,4-D Amine-500 OR 1.5 L/ac 2,4-D Ester-600
Western snowberry	1.7 L/ac+1.5 L/ac 2,4-D Ester-600	1.5 L/ac+1.5 L/ac 2,4-D Ester-600

8. APPLICATION TIPS: • Best application is when crop is under good growing conditions and air temperature 10-25°C. • Avoid application when crop is under stress from adverse environmental conditions. Do not spray if rain is expected within 4 hours. Avoid application if risk of frost or severe drop in night temperature is forecast. • Do not use on bent grass. • Crop damage can occur if the chemical is applied at any time other than the recommended crop stage.

9. HOW IT WORKS: Absorbed through roots and leaves and translocated in phloem and xylem, disrupting the metabolism.

10. EXPECTED RESULTS: ***Weeds:*** Results may take 10-14 days to appear. Proliferation of tissues in plant causes: twisting, bending of main stem, leaf petioles; cupping of leaves; increase in root size; stimulation of fibrous root production. ***Crops:*** Under certain growing conditions shortening of straw can occur in treated crops without having adverse affect on crop yield. If applied at other than recommended crop stage, head and stem deformities may occur. Crops under stress from excess moisture, drought, disease, etc. may suffer a further setback from Banvel. The crop injury that occurs may be offset by the weed control obtained. ***Poor results may be expected if:*** it rains within 4 hours of application, or when older weeds are sprayed, or if less than the recommended water volume is used.

11. EFFECTS OF RAINFALL: Rainfall more than 4 hours after application will not reduce effectiveness.

12. MOVEMENT IN SOIL: Not applicable.

13. GRAZING AND CROPPING RESTRICTIONS: ***DRIFT:*** Can harm ornamentals and other desirable trees or plants.
GRAZING RESTRICTIONS: Canary grass: Seed should only be used as bird seed. ***Cereals:*** Do not graze wheat, barley, oats, or rye prior to maturity. ***Corn:*** Do not graze cattle or harvest for silage until 7 days following treatment with Banvel alone or Banvel plus 2,4-D amine and at least 12 weeks following treatment with other tank mixes. ***Pastures, Rangeland, Non-crop area (meat animals):*** If treated vegetation has been consumed by meat animals within 30 days of Banvel application, feed the animal with untreated diet for 30 days before slaughter. Meat animals may graze or feed on treated pasture 30 days after Banvel application without restrictions on slaughter.
Grazing and Hay Restrictions for Dairy Cattle:

Rate/acre (Banvel 400 g/L)	Rate/acre (Banvel 480 g/L)	Days Delay Between Treatment and Grazing or Cutting For Hay
Up to 600 mL	Up to 500 mL	0
600 mL-1.10 L	501 mL-930 mL	7
1.11 L-2.2 L	931 mL-1.86 L	14
2.21 L-4.4 L	1.87 L-2.87 L	30

SUCCEEDING CROPS: No restrictions unless Banvel has been applied at 1.2 L/ac (400 g/L) or 1.0 L/ac (480 g/L) on fallow or stubble. Then grow only beans (white), cereals, corn (field, sweet), or soybeans the following year. If this application is made after September 1 or if soil is dry subsequent to application, crop injury may occur in the following spring. After Banvel+Roundup for thistle control grow only beans (white), cereals, corn (field, sweet), rapeseed, or soybeans.

14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (1,700-2,900). May cause mild skin irritation and extreme eye irritation and swelling. Non-toxic to fish and birds.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.

16. STORAGE: If frozen, shake thoroughly before use. No activity is lost if completely resuspended.

BASAGRAN (bentazon)
BASF

1. FORMULATIONS: Liquid; 480 g/L; 10 L pack.
2. REGISTERED MIXES: None. ***Surfactants:*** Assist Oil Concentrate, Citowett Plus (peas).
3. CROPS:
   beans [dry (8.1)(black, kidney, pinto, white)]
   beans [lima, snap (8.1)]
   corn (8.8) (field, seed, silage, sweet)
   fababeans (8.6)
   flax (8.8)
   peas [field (8.2), processing (8.3)]
   soybeans
   Underseeding: Not recommended.
4. WEEDS CONTROLLED:
   bird rape
   buttercup
   cocklebur
   chickweed, common (7.2)
   galinsoga, hairy
   groundsel, common (8.5)
   lady's-thumb
   lamb's-quarters (6.2)
   mustard, wild (8.4)
   nightshade, hairy (6.0)
   pigweed, redroot (6.8)
   purslane
   ragweed (common, giant)
   shepherd's-purse (7.3)
   smartweeds, annual (7.0)
   spurry, corn (7.0)
   stinkweed (7.8)
   thistle, Russian (7.9)
5. WEEDS SUPPRESSED: Canada thistle (4.7), field bindweed, redroot pigweed (6.8).
6. WHEN USED: ***Beans (dry, lima, snap):*** 1-3 trifoliate leaves. ***Corn:*** 1-5 leaf. ***Fababeans:*** soon after 3 leaf stage. ***Flax:*** Soon after crop reaches 5 cm. ***Peas (field, processing):*** Soon after 3 pair of leaves form. ***Soybeans:*** unifoliate - 2 expanded trifoliate leaves, usually 18-28 day after planting.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: All crops 710-910 mL/ac. Add 810 mL/ac of Assist Oil Concentrate to increase performance. Reduce Assist rate to 400 mL/ac under hot humid conditions. Do not use Assist on peas, use Citowett Plus at 2.5 L/1000 L of spray solution.
   Water Volume: Air - 20-40 L/ac. Ground - 80-160 L/ac
   Pressure: Air 275 kPa minimum. Ground 275-400 kPa.
   Nozzles: Flat fan or hollow cone only recommended. Tilt 45° forward to ensure better coverage.
8. APPLICATION TIPS: • Do not apply to crops that have been stressed (e.g. hail damage, flooding, drought, widely fluctuating temperatures, prolong cold weather). • Best results when weeds young and actively growing.
9. HOW IT WORKS: Contact herbicide which interferes with photosynthesis. In resistant plants, metabolized to a non-toxic material.
10. EXPECTED RESULTS: ***Weeds:*** Weeds turn yellow initially and then brown, usually within 2 weeks. ***Crops:*** Yellowing, bronzing, speckling, or burning occurs sometimes. The crop usually outgrows the condition within 10 days. ***Poor results may be expected:*** when weeds are beyond recommended growth stage; when spray coverage is poor; or under poor growing conditions.
11. EFFECTS OF RAINFALL: Rainfall within 6-8 hours of application may reduce activity.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Avoid drift on to susceptible crops such as adzuki and mung beans, cucumbers, lentils, mustard, rapeseed, sugar beets, sunflowers. ***Grazing Restrictions:*** Do not feed green plants to livestock. ***Succeeding Crops:*** No restrictions.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (850). Slightly toxic to fish. Non-toxic to birds and bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention immediately.
16. STORAGE: Store in a heated place, freezing will not affect activity. If frozen, warm to room temperature and shake well.

BENAZOLIN (benazolin)

Ciba-Geigy

1. FORMULATIONS: Liquid; 330 g/L; 4 X 5 L containers.
2. REGISTERED MIXES: None.
3. CROPS: Rapeseed (7.9). ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED: Wild mustard (7.8)
5. WEEDS SUPPRESSED: Canada thistle (3.7)
6. WHEN USED: Rapeseed: 3-5 true leaf stage; wild mustard: 2-4 leaves.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: 600-850 mL/ac
   Water Volume: 22-40 L/ac
   Pressure: 275 kPa
8. APPLICATION TIPS: Remove all traces of herbicides from sprayer before spraying rapeseed - this is **absolutely essential**.
9. HOW IT WORKS: Not known.
10. EXPECTED RESULTS: Kill or suppress wild mustard.
11. EFFECTS OF RAINFALL: Do not spray if rain is expected within 4 hours.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: Avoid drift. No restrictions on grazing crop use after hail, or succeeding crops.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,000). May irritate skin and eyes. Non-toxic to birds; slightly toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). If irritation persists see a doctor. IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Heated storage is essential.

BLADEX LIQUID, BLADEX 80W (cyanazine)

Ciba-Geigy

1. FORMULATIONS: Liquid; Bladex Liquid; 480 g/L; 10 L jugs. Wettable Powder; Bladex 80W; 80%; 5 kg bags.
2. REGISTERED MIXES: Atrazine, Dual Ciba-Geigy 960E, Eradicane, Sutan+ . ***Mix Restrictions:*** Do NOT mix with any oils or adjuvants, other than Bio-Veg crop oil.
3. CROPS: Corn (field and sweet) (9.0).
4. WEEDS CONTROLLED:

buckwheat, wild	kochia	nightshade, black	shepherd's-purse
foxtail (green, yellow)(6.8)	lady's-thumb	pigweed, redroot (6.2)	smartweeds, annual
goosefoot, oak-leaved	lamb's-quarters	purslane, common	stork's-bill
grass, barnyard	mustard (wild, wormseed)	ragweed (common, false)	thistle, Russian
knotweed, prostrate			

5. WEEDS SUPPRESSED: None.
6. WHEN USED: Pre-plant incorporation on dryland, or pre-emergent followed in 5-7 days with irrigation. **NOTE:** Bladex 80W may be also applied, with crop oil, early post-emergent.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: Liquid=L/ac; 80W=kg/ac. Pre-plant - 1.7-2.0 L/ac (1.0-1.2 kg/ac) Pre-emergent (only with irrigation) - 1.9-2.3 L/ac (1.1-1.4 kg/ac) Early post-emergent - 1.1 kg/ac. Use lower rates for light textured soils and higher rates for heavier soils.
   Water Volume: 60-80 L/ac.
   Pressure: 200-300 kPa.
8. APPLICATION TIPS: • Do not use Bladex on soils with more than 70% sand or less than 1% organic matter.
   • For early post-emergent application: add 1 L Bio-Veg crop oil/100 mL spray solution. Do not apply beyond the 3 leaf stage of corn (approx. 7.5 cm).
   • A timely inter-row cultivation will control any seedling weeds which escape the treatment.
9. HOW IT WORKS: Active through root uptake, requires moisture to carry it to root zone. Interferes with photosynthesis.
10. EXPECTED RESULTS: Weeds fail to emerge or die before reaching 2-3 leaf stage.
11. EFFECTS OF RAINFALL: Rainfall or irrigation required for activation. Heavy rainfall on very sandy soil may cause leaching and reduce effectiveness.
12. MOVEMENT IN SOIL: Negligible unless excess moisture on very sandy soil.
13. GRAZING AND CROPPING RESTRICTIONS: Where atrazine mix is used, corn should follow corn.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (334). Low toxicity to fish and birds.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical aid.
16. STORAGE: Not damaged by freezing. Store in a dry place.

BLADEX TTC (cyanazine)

Ciba-Geigy

1. FORMULATIONS: Liquid; 480 g/L; 10 L containers.
2. REGISTERED MIXES: Poast. ***Mix Restrictions:*** Add 1/2 the required amount of water, start agitation, add Bladex TTC, add more water, then Poast, then Assist oil concentrate, then remaining water.
3. CROPS: Triazine tolerant canola.
4. WEEDS CONTROLLED:

buckwheat, wild	hemp-nettle	pigweed, redroot
chickweed	lady's-thumb	rapeseed (volunteer non-triazine tolerant)
cleavers	lamb's-quarters	shepherd's-purse
groundsel, common	mustard, wild	smartweeds, annual
		stinkweed

5. WEEDS SUPPRESSED: None.
6. WHEN USED: When crop and weeds are in 1-4 leaf stage.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: Bladex TTC - 1.2 L/ac. Bladex TTC - 1.2 L/ac + Poast - 325-770 mL/ac.
   Water Volume: 40 L/ac
   Pressure: 275 kPa
   Nozzles: Flat fan recommended; screens 50 mesh or larger.
8. APPLICATION TIPS: Optimum weed control is achieved when weeds are small and actively growing; later applications will be less effective.
9. HOW IT WORKS: Inhibits photosynthesis.
10. EFFECTS OF RAINFALL: Rainfall within 2 hours of application may reduce effectiveness.
11. MOVEMENT IN SOIL: Not applicable
12. GRAZING AND CROPPING RESTRICTIONS: No cropping restrictions.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (334). Low toxicity to fish and birds.
14. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical aid.
15. STORAGE: Not damaged by freezing. Store in a dry place.

BLAGAL (cyanazine + MCPA-K)

Ciba-Geigy

1. FORMULATIONS: Liquid; 125 g/L of cyanazine + 250 g/L MCPA-K; 2 X 10 L pack.
2. REGISTERED MIXES: None. ***Mixing Restrictions:*** Vigorous agitation is necessary if the solution stands for several hours before spraying.
3. CROPS: Barley (8.5), oats (9.0), wheat [spring (8.7)]. ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED:

buckwheat	hemp-nettle (7.9)	mustard (ball, tumble, wild,	smartweeds, annual
[Tartary (8.2), wild (7.2)]	lady's-thumb	wormseed)(8.7)	spurry, corn
chickweed (7.6)	lamb's-quarters (8.7)	radish, wild	stinkweed (8.7)
			MCPA-K susceptible weeds

5. WEEDS SUPPRESSED: Canada thistle, horsetail.
6. WHEN USED: Cereals, 2-5 leaf stage. Canada thistle, delay application until cereals have reached 5 leaf stage.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 910 mL/ac
   Water Volume: 40 L/ac minimum.
   Pressure: 200-300 kPa.
   Nozzles: Flat fan recommended; screens 50 mesh or larger.
8. APPLICATION TIPS: • Boom Angle: Direct spray straight down.
   • Application after 5 leaf stage may cause serious crop injury and give poor weed control.
   • Allow 4 days before or after wild oat herbicide application.
9. HOW IT WORKS: Cyanazine and MCPA-K act synergistically to disrupt metabolism and inhibit photosynthesis.
10. EXPECTED RESULTS: ***Weeds:*** Yellow blotches first appear in 5-10 days then the whole plant turns yellow and brown and dies. Young vigorously growing plants affected first. ***Crop:*** Under moisture or temperature stress, Blagal may cause temporary yellowing of lower leaves. ***Poor results may be expected if:*** • Reduced application rate. • Poor penetration through dense crop canopy. • Extremely poor growing conditions (droughty). • Late application.
11. EFFECTS OF RAINFALL: Rain within 4 hours will seriously reduce activity.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze or feed green plants to livestock. ***Crop Use After Hail:*** Use if mature. ***Succeeding Crops:*** No restrictions.
14. TOXICITY: Moderate-high acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = Cyanazine (334), MCPA (700). Non-toxic to fish, birds, and bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid contact with skin or eyes. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Not damaged by freezing. Store in dry area and shake well before use. To re-suspend, warm and agitate.

BUCTRIL M (bromoxynil + MCPA)

May & Baker

WARNING POISON

1. FORMULATIONS: Emulsifiable Concentrate; 280 g/L bromoxynil + 280 g/L MCPA; 8 L jugs.

2. REGISTERED MIXES: Asulox F, Atrazine, Avenge, MCPA (amine, ester, K salt), Poast + Assist, TCA,
Mix Restrictions: • Atrazine - add Atrazine (450-910 g active/ac) to tank first. Do not add oil or surfactant. Observe precautions and limitations of both labels. • Asulox F or TCA - Prepare Buctril M mix, then add Asulox F or TCA. • Avenge - add 1/2 of the water, add Buctril M, add rest of water, add Avenge. • MCPA - add 1/2 of the water, add MCPA, agitate, add rest of water, add Buctril M.

3. CROPS:

barley (8.8)
canary grass (8.5)
corn (field, sweet)(9.0)
flax (8.4)
oats (8.8)
rye, fall
wheat (durum, spring)
wheat, winter (fall or spring applied) (8.6)

Underseeding: Not recommended

Seedling Grasses (for seed)

brome grass (8.9)
canary grass, reed
fescue [creeping red, meadow (8.3)]
orchard grass (8.9)
Russian wild ryegrass (9.0)
timothy (8.8)
wheatgrass (8.5)(crested, intermediate, slender, tall)

4. WEEDS CONTROLLED:

bluebur
buckwheat [Tartary, volunteer, wild (8.1)]
catchfly, night-flowering
chamomile, scentless (7.6)
cocklebur
cockle, cow (7.8)
flixweed
groundsel, common
kochia (6.7)
lady's-thumb
lamb's-quarters (8.6)
mustard (8.4) (ball, wild, wormseed)
nightshade, American
pigweed, redroot (7.9)
ragweed, common
rapeseed, volunteer (8.7)
shepherd's-purse
smartweeds, annual (8.2)
stinkweed (8.9)
sunflower, volunteer
thistle, Russian (7.4)

5. WEEDS SUPPRESSED: Canada thistle and perennial sow-thistle.

6. WHEN USED: Cereals - 2 leaf to early flag leaf. Winter wheat, fall rye - 2-4 leaf (fall); - after growth begins to early flag leaf (spring). Canary seed - 3-5 leaf. Flax - 5-10 cm. Corn - 4-6 leaf. Seedling Grasses - 2-4 leaf (establishment year only, not underseeded to legumes). Weeds - before 5 leaf stage. Buckwheats, stinkweed, mustards (wild, wormseed), lamb's-quarters, ragweed, groundsel - up to 8 leaf stage.

7. HOW TO APPLY:
With: Aircraft or Ground equipment.
Rate: 400 mL/ac.
Water Volume: Air: 8 L/ac or more. Ground: 20 L/ac or more. Corn: 80-120 L/ac. Seedling Grasses: 60 L/ac.
Pressure: 275 kPa
Nozzles: Flat fan recommended.

8. APPLICATION TIPS: • Avoid spraying during a severe drought. Under conditions of high temperature and humidity, slight discolouration of cereals may occur but no effect on crop yields. • Flax is less tolerant than cereals, therefore do not spray flax in hot humid weather when day time temperatures are over 25-29°C. • Best results are achieved when weeds are sprayed in seedling stage, with good spray coverage. • Corn: Buctril M at 400 mL/ac, as an overall spray only up to 6 leaf stage. Buctril M + Atrazine for a broader spectrum of weed control. Cultivation after application is not recommended.

9. HOW IT WORKS: Bromoxynil is a contact type herbicide, therefore, good spray coverage is essential. Inhibits photosynthesis and plant respiration. MCPA is absorbed through leaves and is readily translocated in the plant.

10. EXPECTED RESULTS: Small burnt spots on the leaf can appear within hours, death takes up to 2 weeks. ***Poor results may be expected if:*** Poor coverage. Poor penetration through crop canopy.

11. EFFECTS OF RAINFALL: No effect.

12. MOVEMENT IN SOIL: Not applicable.

13. GRAZING AND CROPPING RESTRICTIONS: No grazing or crop use restrictions.

14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (365). Very toxic to fish and birds. Non-toxic to bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Does not require heated storage.
NOTE: Similar products Sabre/Bromox 720 are listed on page 85.

CALMIX PELLETS (bromacil + 2,4-D)

Union Carbide

1. FORMULATIONS: Pellets; 3.0 + 5%; 1 kg, 5 kg bags.
2. REGISTERED MIXES: None.
3. CROPS: Non-crop areas only.
4. WEEDS CONTROLLED: Non-selective.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: May be applied during the growing season, but to prevent growth apply in fall or early spring.
7. HOW TO APPLY:
   With: Calmix spreader or shaker.
   Rate: 2.5 kg/100 m^2 - annual weeds and perennial seedlings.
   3.75 kg/100 m^2 - shallow-rooted perennials.
   5.0 kg/100 m^2 - heavy perennial growth.
   • Apply higher rate to heavier soils and/or to extend the growth control period.
   • Spot treatment - 37.5 g to about 1 m^2. Repeat treatment when required.
   • Around utility poles, treat 1.25 m around each pole, 250 g/pole.
8. APPLICATION TIPS: • Do not use near lawns or flower beds. • Do not apply closer than 1.5 times the height of nearby trees. • Do not apply on slopes where water erosion may carry chemical onto areas of desirable vegetation. • Do not contaminate water used for irrigation or other domestic uses.
9. HOW IT WORKS: Systemic action, enters plant via roots.
10. EXPECTED RESULTS: Vegetation turns brown and dies. No new growth will appear, resulting in bare ground. Rapidity and duration of control will depend upon amount of chemical applied, soil type and environmental conditions. ***Poor results may be expected if:*** Inadequate application rate. Soil erosion removes chemical from treated area when applied on slopes. Insufficient rainfall to activate chemical.
11. EFFECTS OF RAINFALL: Moisture will activate and carry the herbicide into the root zone.
12. MOVEMENT IN SOIL: Once fixed in the soil there is very little lateral movement. Pellets can be carried by erosion.
13. GRAZING AND CROPPING RESTRICTIONS: Not applicable.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = bromacil (5,200); 2,4-D (375). Slightly toxic to fish. Non-toxic to birds.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid exposure to dust. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6).
16. STORAGE: Store in dry area.

CARBYNE 2EC (barban)

Transbas

1. FORMULATIONS: Emulsifiable Concentrate; 240 g/L; 19 L container.

2. REGISTERED MIXES: Avenge 200-C [barley, wheat (durum, spring)]. See Avenge label for restrictions on wheat varieties.
Mix Restrictions: Do not add surfactants, wetting agents, or other chemicals to spray solution unless specified on the Carbyne label.

3. CROPS:

alfalfa (8.7)	fababeans (8.7)	sugar beets (9.0)	***Seed Production (seedlings only)***
barley (8.8)	flax (7.7)	sunflowers (8.6)	fescue, creeping red (8.9)
brome grass, smooth (8.2)	lentils (8.4)	wheat [durum, spring (8.9)]	timothy (8.3)
canola (8.9)	mustard (8.9)		wheatgrass, crested (8.6)
clover [alsike (8.9),	peas [field, processing (8.8)]		
red (9.0), sweet (6.0)]	ryegrass, Russian wild (8.1)		

4. WEEDS CONTROLLED: Wild oats (6.6)

5. WHEN USED:

Crop:	Stage:
Barley, lentils, wheat (durum, spring).	Before the 4-leaf stage or the 14th day after emergence whichever is first.
Canola, fababeans, mustard, sugar beets, sunflowers.	When wild oats are in the 2-leaf stage.
Flax	After the 2 (true) leaf stage but before the 12-leaf stage appears and before 14 days after emergence.
Peas	Before the 6-leaf stage.
Forages, grasses, legumes. (For seed production only; in establishment year only)	Before the 4-leaf stage.
Weed:	
Wild oats	When majority are in 2-leaf stage.
	Carbyne+Avenge: 3-4 leaf stage.

6. HOW TO APPLY:
With: Aircraft or Ground equipment. Do not apply Carbyne+Avenge mix by air.
Rate: 600-700 mL/ac; Sugar beets - 810-1415 mL/ac. Higher rate when the wild oat density is 50 plants/m² or more, or when wild oats are not actively growing, or when wild oats have been injured by frost or wind. Carbyne+Avenge 200-C Mix: 340 mL/ac Carbyne+810 mL/ac Avenge 200-C.
Water Volume: ***Aircraft:*** 10-18 L/ac; ***Ground:*** 18 L/ac. ***Carbyne+Avenge:*** (Ground only) 25-30 L/ac
Pressure: 300 kPa (minimum)
Nozzles: TeeJet 650067, 730067, 800067; Delavan LF.67-65, LF.77-73, LF.67-80 Spray Jet 65.067, TK.75 or D.75.

7. APPLICATION TIPS: • Wild oat seedlings produce a new leaf every 5 days and under good growing conditions reach the 2-leaf stage 4-9 days after emergence. Degree of control is dependent upon the uniformity of emergence of the wild oats. •No restrictions on applications of other pesticides after Carbyne. For Carbyne+Avenge, allow 4 days between the application and use of esters of bromoxynil; 2,4-D; or MCPA. • Crop damage may occur if sprayed within 24 hours of frost. • Do not make a second application at a later date on grain crops.

8. HOW IT WORKS: A partially systemic herbicide: penetrates the leaf and stem surfaces of the wild oat plant, interfering with cell division.

9. EXPECTED RESULTS: Wild oat growth stops and leaves turn blue-green within 7-10 days. A swelling of the stem at ground level may occur. Leaf tips turn brown, the plant becomes brittle, dying 3-4 weeks after treatment.

10. EFFECT OF RAINFALL: Do not apply when the crop is wet with dew or rain. Rainfall within 15 minutes after application may decrease control.

11. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** The hazard is low, however, common oats, buckwheat and rye can be seriously affected. ***Grazing Restrictions:*** Do not graze, cut for forage, or feed crop for 5 weeks after treatment. Do not feed the lower 8 cm of pea vines to livestock.

12. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (2,750). **Long-term exposure to this product has sensitized some people to it.** Very toxic to fish.

13. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - Do NOT induce vomiting. Get medical attention.

14. STORAGE: May be stored at freezing temperatures but must be returned to its original state by warming to room temperature and agitating thoroughly.

CASORON (dichlobenil)

Pfizer

1. FORMULATIONS: Granular; 4%; 2.25 kg shaker jug, 15 kg pack.
2. REGISTERED MIXES: None
3. CROPS:

arbor vitae	cedar, white	juniper	non-crop areas
ash	crabapple	linden	raspberries
birch, cutleaf weeping	fruit trees	maple	willow
caragana shelterbelts	honeysuckle		

4. WEEDS CONTROLLED:

artemisia	groundsel	mustard	shepherd's-purse
bindweed	horsetail	pigweed	smartweeds
bluegrass, annual	knotweed	purslane	spurge
chickweed	lamb's-quarters	quackgrass	thistle, Canada
foxtail			

5. WEEDS SUPPRESSED: None.
6. WHEN USED: For best results apply when soil temperatures are cool. ***Annual Weeds:*** apply to prepared weed-free soil either in early spring before seeds of annuals germinate or after cultivation has removed weeds. Do not apply until 4 weeks after transplanting tolerant crops. ***Perennial Weeds:*** apply in fall (October 15 until soil freeze-up) on crops established for at least 1 year. Quackgrass, artemisia in established woody ornamentals apply in fall and again in the early spring before May 1. ***Raspberries:*** apply in late fall but before soil freeze-up. Do not cultivate or work into the soil. Do not apply in spring as injury may occur.
7. HOW TO APPLY:
   With: Ground granular applicator.
   Rate: Annual weeds - 45-70 kg/ac, based on area actually treated. Quackgrass, artemisia in woody ornamentals - 60 kg/ac in fall; 60 kg/ac again in spring. Quackgrass, thistles, bindweed in woody ornamentals - 91-111 kg/ac. Raspberries - 71 kg/ac.
8. APPLICATION TIPS: • Do not use on light sandy soils with less than 2% organic matter. • Do not use on firs, hemlock, lilac, spruce, Mugho pine nor on herbaceous perennials. • Do not use in seed beds, transplant, or cutting beds or in greenhouses.
9. HOW IT WORKS: Snow melt or rain moves Casoron into the soil. Casoron inhibits germination but acts primarily on growing points and root tips.
10. EXPECTED RESULTS: Growth of emerging shoots of some perennials controlled. Tolerant crops are unaffected if roots do not come in contact with Casoron in the upper layers of the soil.
11. EFFECTS OF RAINFALL: If it is dry, poor results can be expected.
12. MOVEMENT IN SOIL: Some movement in coarse-textured soils.
13. GRAZING AND CROPPING RESTRICTIONS: Do not transplant into treated soil for 1 year. Do not plant vegetables or other sensitive crops the year following treatment. Do not graze livestock in treated areas.
14. TOXICITY: Very low mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,160). Slightly toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid skin and eye contact. IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Dry storage - not affected by frost.

CO-OP GRANULAR SOIL STERILANT
(sodium metaborate tetrahydrate + sodium chlorate + diuron)
Federated Co-op

1. FORMULATIONS: Dry granule; 66.5 + 30 + 1.25%; 1 kg, 4 kg, 22.7 kg bags.
2. REGISTERED MIXES: None
3. CROPS: Non-crop areas; where long term, total vegetation control is desired.
4. WEEDS CONTROLLED: All growth. Annual broadleaf weeds and grasses. Perennial weeds.
5. WEEDS SUPPRESSED: Not applicable.
6. WHEN USED: In early spring when weeds are small, up to 15 cm tall, or in fall when weeds are dormant.
7. HOW TO APPLY:
   With: Shaker can, mechanical spreader or knapsack sprayer.
   Rate: ***Annual weeds:*** 0.5-1 kg/10 m^2 - for dry application apply when rain is expected or water in. ***Persistent perennial weeds:*** 1-2 kg/10 m^2 - either at maturity of weed or on damp soil in spring. Use higher rates on deep rooted perennials.
8. APPLICATION TIPS:
   Limitations
   - Do not apply in hot, dry weather.
   - To avoid fire hazard from dead and dry vegetation, treat when weeds are small. If growth is well advanced, mow and rake before treatment.
   - Do not apply on or near desirable plants or on areas into which their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots.
   - Dried chemical residue on organic matter can be explosive.
   - Spray solution will damage leather.
9. HOW IT WORKS: Kills through contact action. Persists in the soil and provides prolonged control of germinating seedlings and re-growth from perennial roots. Length of control depends on: species, rate, soil type, rainfall, vegetation cover, and time of application.
10. EXPECTED RESULTS: Seedlings are controlled quickly. Slower kill on perennial weeds.
11. EFFECTS OF RAINFALL: Rainfall will move the chemical into the soil and enhance its activity; in areas of high rainfall or sandy soils, the residual effect is reduced due to leaching.
12. MOVEMENT IN SOIL: Limited.
13. GRAZING AND CROPPING RESTRICTIONS: Treated area will be rendered more or less unproductive for 1 or more years.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (2,300-3,500). May cause irritation of eyes, nose, throat and skin.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in cool, dry place. Avoid direct contact with ground or concrete floors when storing.

DESORMONE LV700, DIPHENOPROP 700 (2,4-D + dichlorprop)

Union Carbide/Pfizer

WARNING POISON

1. FORMULATIONS: Emulsifiable Concentrate; 350 g/L 2,4-D + 350 g/L dichlorprop; 4 L, 10 L, 20 L containers.
2. REGISTERED MIXES: DyCleer. ***Mix Instructions:*** Add 1/2 amount of carrier, start agitation, add herbicide, add rest of carrier. If used in oil, do not let water get in mixture.
3. CROPS: Non-crop areas, industrial areas, rights of way, roadsides.
   Underseeding: Not applicable.
4. WEEDS CONTROLLED:

Brush

alder	cedar, white	hazel	plum, wild
apple, wild	cherry, wild	hickory	poison-ivy
aspen	elderberry	honeysuckle	poplar
basswood	elm	juniper, ground	raspberry (tame, wild)
birch	fir, balsam	maple (Manitoba, silver)	sumac
blueberry	hardhack	oak (bur, white)	tamarac
buckbrush	hawthorn	pine (red, Scotch)	willow

Weeds

alfalfa	clover, sweet	hawkweed	teasel
burdock	dandelion	horsetail	thistle (bull, Canada)
buttercup	dock, curled	mullein	vetch
carrot, wild	dogbane	plantain	yellow rocket
chicory	goat's-beard	sow-thistle, perennial	most annual broadleaf weeds
cinquefoil	goldenrod	tansy	

5. WEEDS SUPPRESSED: milkweed, rose, sugar maple, toadflax.
6. WHEN USED: Throughout growing season.
7. HOW TO APPLY:
   With: Aircraft, power equipment, knapsack sprayer.
   Rate: Brush: 7.0-11.0 L in 1000 L of water for foliage stem treatment. Weeds: 1.42-2.02 L/ac.
   Water Volume: Spray to point of run-off. For fixed wing application - 8 L/ac minimum. Water may be replaced by oil.
   Pressure: As recommended for equipment used.
8. APPLICATION TIPS: Forms an emulsion in water - agitate to prevent separation.
9. HOW IT WORKS: A translocated, systemic herbicide absorbed by leaves.
10. EXPECTED RESULTS: Leaves brown and wilt shortly after spraying - no leaves appear the following year.
11. EFFECTS OF RAINFALL: Rain within 3 or 4 hours after application may reduce control.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: No grazing restrictions. ***Drift*** over susceptible crops causes injury.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = 2,4-D (300-1000); dichlorprop (800). Toxic to bees. 2,4-D present contains no dioxin.
15. PRECAUTIONS, FIRST AID: Do not apply when bees are foraging. Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: If frozen, warm to 5°C and mix well.
    NOTE: Similar products, Estaprop/Silvaprop 700, are listed on page 48.

DUAL CIBA-GEIGY 960E (metolachlor)

Ciba-Geigy

1. FORMULATIONS: Emulsifiable Concentrate; 960 g/L; 2 X 10 L pack, 1 X 110 L drum.
2. REGISTERED MIXES: May be applied as split application or tank mixed as follows. With Aatrex Liquid, Aatrex Nine-O, Bladex formulations, or Banvel. Kil-Mor and Estemine 2,4-D: split application only. Liquid nitrogen - 28% nitrogen solutions or complete liquid fertilizers may replace all or part of the water for pre-plant incorporated or pre-emergent application of Dual tank mixes in corn. Dry Bulk Granular Fertilizers - impregnate on fertilizer, soil apply, then incorporate to 5 cm. ***Mix Restrictions:*** Do not tank mix with Kil-mor or Estemine 2,4-D. Do not impregnate on nitrate fertilizers (ammonium, potassium, sodium, calcium) or on single superphosphate (0-26-0), triple superphosphate (0-46-0) or on ammonium phosphate or on limestone. Fertilizer blends containing limestone may be impregnated.
3. CROPS: All corn.
4. WEEDS CONTROLLED: Barnyard grass, green and yellow foxtail plus weeds controlled by the second material in mix or oversprayed.
5. WEEDS SUPPRESSED: None.
6. WHEN USED: Pre-plant incorporated (PPI). Pre-emergent (PRE) under irrigation only.
7. HOW TO APPLY:
   With: Ground equipment - band or overall spray.
   Rate: Corn - 0.8-1.1 L/ac
   Corn - Tank mixes of Dual Ciba-Geigy 960E at above rate plus:

	Tank Mixes (Qty/ac)		Split Application
Weeds Controlled	**ppi***	**pre****	**post*****
Annual grasses and broad-leaf weeds	Aatrex Nine-0 - 0.5-0.7 kg/ac OR Aatrex Liquid - 0.9-1.3 L/ac OR Bladex 80W - 1.0-1.2 kg/ac OR Bladex Liquid - 1.5-1.9 L/ac	Aatrex Nine-0 - 0.5-0.7 kg/ac OR Aatrex Liquid - 0.9-1.3 L/ac OR Bladex 80W - 0.9-1.1 kg/ac OR Bladex Liquid - 1.7-2.0 L/ac	Kilmor - 345-445 mL/ac OR Estemine 2,4-D - 285-445 mL/ac

   ****pre-plant incorporated; ** pre-emergence (under irrigation only); *** post emergence***
   Water Volume: 70-140 L/ac
   Incorporation: Incorporate to 5 cm. Do not exceed this depth since product dilution can occur. If using tandem discs set to cut to a depth of 10 cm operated at 6-9 km/h. If using vibrating shank cultivators with overlapping sweeps, set 10 cm deep and operate at 10-13 km/h. Spike tooth or diamond tooth harrows are good incorporation equipment. Immediate incorporation is not necessary although desirable.
   Pressure: 200-300 kPa
8. APPLICATION TIPS: • For band treatments, use a press wheel ahead of the nozzle to level the band.
9. HOW IT WORKS: Inhibits germination, particularly grasses.
10. EXPECTED RESULTS: Annual grasses do not germinate or under dry conditions may die back soon after emergence.
11. EFFECTS OF RAINFALL: Moisture required to move chemical to area of germination but an excess may move it below this area.
12. MOVEMENT IN SOIL: Some movement may occur if excess moisture or light soil.
13. GRAZING AND CROPPING RESTRICTIONS: Do not apply on muck, peat or high organic soils, or after growth has begun. Winter cereals may be seeded 4.5 months after treatment.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (2,780). Prolonged exposure may cause eye injury. Slightly toxic to birds; non-toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: Heated storage required.

DYCLEER (dicamba)

Sandoz Agro

1. FORMULATIONS: Liquid - 400 g/L; 10 L jug. - 480 g/L; 9.5 L jug. **Rates shown below refer ONLY to 480 g/L formulation.**

2. REGISTERED MIXES: 2,4-D (Amine, LV Ester); 2,4-D + dichlorprop (Desormone LV 700, Diphenoprop 700, Silvaprop 700). ***Mix Restrictions:*** Do not mix with oils. Aerial tank mixes are only labelled for use on: aspen poplar, red pine, white birch, willow.

3. CROPS: Non-crop areas, turf (established).

4. WEEDS CONTROLLED:

Weeds			
0.50 L/ac DyCleer (Turf)	**0.95 L/ac DyCleer**	**1.90 L/ac DyCleer**	**3.7 L/ac DyCleer**
chickweed, mouse-eared	bindweed, field	cherry, ground	baby's breath
clover	daisy, English	goat's-beard	lambkill
knotweed, erect	goldenrod	knapweed, diffuse	sage brush, fringed
sorrel, sheep	ragweeds (common, false, giant)	poverty weed	
0.85 L/ac DyCleer +	ragwort, tansy	sage, pasture	
1.8 L/ac 2,4-D Amine 500	sow-thistle, perennial	sorrel, sheep	
wild carrot	thistle, Canada	spurge, thyme-leaved	
Brush - Group 1	**Group 2**		**Group 3**
alder	basswood	oak (bur, red)	ash, white
rose, wild	birch	pine	maple, sugar
poplar, aspen	cottonwood, black	poplar, balsam	
snowberry, western	elm	spruce	
willow, wolf	fir, balsam	tamarack	

5. WEEDS SUPPRESSED: Top growth control

0.50 L/ac DyCleer		**0.95 L/ac DyCleer**	**3.7 L/ac DyCleer**
absinthe	sow-thistle, perennial	curled dock	cinquefoil, perennial
chamomile, scentless	spurge, leafy		knapweed, Russian
poverty weed	thistle, Canada		

6. WHEN USED: ***Coniferous and Deciduous species:*** when leaves are fully expanded (spring-early summer) and stop applications at least 3 weeks prior to a change of leaf colour in the fall. ***Broad-leaf weeds:*** when actively growing, normally between May and July.

7. HOW TO APPLY:
With: Aircraft or Ground equipment. Thorough coverage essential.
Rate: ***480 g/L. See Weeds Controlled, Weeds Suppressed.*** Rates vary depending on species. ***Broadleaf Weeds:*** 0.50 L/ac, 0.95 L/ac, 1.90 L/ac, or 3.7 L/ac DyCleer. ***Wild Carrot:*** 0.85 L/ac DyCleer + 1.8 L/ac 2,4-D Amine. ***Brush: Rates/1000 L of water*** Group 1 - 2.1 L DyCleer + 4.0 L 2,4-D Amine **OR** 3.3 L 2,4-D Ester 600; Group 2 - 4.0 L DyCleer + 8.0 L 2,4-D Amine **OR** 6.6 L 2,4-D Ester 600; Group 3 - 5.2 L DyCleer + 7.1 L (2,4-D + dichlorprop).
Water Volume: Aircraft - 35 L/ac minimum. Ground - Turf Weeds: 45 L/ac; Weeds: 45-90 L/ac; Brush: rate/1000 L of water, applied to run-off.

8. APPLICATION TIPS: • Thorough coverage of weed and wetting brush to the point of run-off is essential for control. • Brush and trees over 2 m should be cut and regrowth sprayed. • Do not use on bent grass. Do not rake, mow, or water turf within 24 hours after treatment. • 2,4-D Ester tank mix may improve brush control, especially under drought stress. Tank mix with 2,4-D (Amine or Ester) for control of a broader range of weeds. • Avoid applications if temperatures exceed 30°C to reduce risk of vapour drift. • Avoid applications onto soil over the root systems of desirable trees and shrubs. • Thoroughly clean application equipment after use.

9. HOW IT WORKS: Dicamba is a systemic herbicide that is absorbed through roots or leaves and translocated in most plants. Disrupts the metabolic and growth activities in the plant.

10. EXPECTED RESULTS: Excellent control of brush can be expected within a year of application. Effect on broad-leaf weeds may be seen in 10-14 days resulting in twisting and bending of the main stem, cupping of leaves, increase in root size and stimulation of fibrous root production.

11. EFFECTS OF RAINFALL: Rainfall 4 hours after application will not reduce effectiveness.

12. MOVEMENT IN SOIL: Very little can leach downward.

13. GRAZING AND CROPPING RESTRICTIONS: Not applicable.

14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = dicamba DMA salt (2,600). Low toxicity to fish. Non-toxic to bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.

16. STORAGE: Freezing may cause crystalization but no activity is lost if completely resuspended.

DYCLEER 24 (dicamba + 2,4-D amine)

Sandoz Agro

WARNING POISON

1. FORMULATIONS: Liquid; 200 g/L dicamba + 400 g/L 2,4-D amine; 10 L jug.
2. REGISTERED MIXES: None. ***Mix Restrictions:*** Do not mix with oils.
3. CROPS: Non-crop areas, turf (established).
4. WEEDS CONTROLLED:

Weeds			
1.1 L/ac (Turf)	**2.2 L/ac**	**4.5 L/ac**	
chickweed, mouse-eared	carrot, wild	cherry, ground	sage, pasture
clover	daisy, English	goat's-beard	sorrel, sheep
dandelion	goldenrod	knapweed, diffuse	spurge, thyme-leaved
knotweed, erect	ragweeds (common, false, giant)	poverty weed	
plantain	ragwort, tansy		
sorrel, sheep			
Brush 5.0 L/1000 L Water	**10.0 L/1000 L Water**		
alder	basswood	fir, balsam	tamarack
poplar, aspen	birch	oak (bur, red)	
rose, wild	cedar (red, white)	pine	
snowberry, western	cottonwood, black	poplar, balsam	
willow, wolf	elm	spruce (red, white)	

5. WEEDS SUPPRESSED: Top growth control. • = apply to regrowth in summer and fall.

1.1 L/ac		**2.2 L/ac**	
absinthe	sow-thistle, perennial	bindweed, field•	dock, curled
chamomile, scentless	spurge, leafy	sow-thistle, perennial•	
poverty weed	thistle, Canada	thistle, Canada•	

6. WHEN USED: ***Coniferous and Deciduous species:*** when leaves are fully expanded (spring-early summer) and stop applications at least 3 weeks prior to a change of leaf colour in the fall. ***Broad-leaf weeds:*** when actively growing, normally between May and July.
7. HOW TO APPLY:
   With: Conventional boom sprayer, handgun, or boomless type sprayer. Thorough coverage essential.
   Rate: ***See Weeds Controlled, Weeds Suppressed.*** Rates vary depending on species. ***Turf Weeds:*** 1.1 L/ac. ***Broadleaf Weeds:*** 1.1 L/ac, 1.7 L/ac, 2.2 L/ac, 4.5 L/ac. ***Brush:*** Rate/1000 L of Water; 5.0 L, 10.0 L.
   Water Volume: Turf Weeds: 45 L/ac. Broadleaf Weeds: 45-90 L/ac. Brush: rate/1000 L of water, applied to run-off.
8. APPLICATION TIPS: • Thorough coverage of weed and wetting brush to the point of run-off is essential for control. • Brush and trees over 2 m should be cut and regrowth sprayed. • Do not use on bent grass. Do not rake, mow, or water turf within 24 hours after treatment. • Avoid applications if temperatures exceed 30°C to reduce risk of vapour drift. • Avoid applications onto soil over the root systems of desirable trees and shrubs. • Thoroughly clean application equipment after use.
9. HOW IT WORKS: Dicamba is a systemic herbicide that is absorbed through roots or leaves and translocated in most plants. Disrupts the metabolic and growth activities in the plant.
10. EXPECTED RESULTS: Excellent control of brush can be expected within a year of application. Effect on broad-leaf weeds may be seen in 10-14 days resulting in twisting and bending of the main stem, cupping of leaves, increase in root size and stimulation of fibrous root production.
11. EFFECTS OF RAINFALL: Rainfall 4 hours after application will not reduce effectiveness.
12. MOVEMENT IN SOIL: Very little can leach downward.
13. GRAZING AND CROPPING RESTRICTIONS: Not applicable.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = dicamba DMA salt (2,500). Low toxicity to fish. Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Freezing may cause crystalization but no activity is lost if completely resuspended.

DYVEL (dicamba + MCPA-K)

Sandoz Agro

1. FORMULATIONS: Water soluble solution; 84 g/L dicamba + 336 g/L MCPA-K; 10 L jugs.
2. REGISTERED MIXES: None
3. CROPS: Barley (8.6), oats (9.0), wheat [spring (8.7), winter]. ***Underseeding:*** Legume underseeding not recommended.
4. WEEDS CONTROLLED:

buckwheat	hemp-nettle (6.5)	pigweed (prostrate, redroot	spurry, corn (5.6)
[Tartary, wild (7.1)]	kochia	(8.8), Russian)	stinkweed (8.4)
burdock	lady's-thumb	radish, wild	sunflower, volunteer
cockle, cow	lamb's-quarters (8.6)	ragweeds (common, false, giant)	thistle, Russian (7.0)
cocklebur	mustard (8.8)(ball, hare's ear,	shepherd's-purse	
flixweed	Indian, tumble, wild,	smartweeds, annual (7.7)	
	wormseed)		

5. WEEDS SUPPRESSED: Canada thistle (6.8), sow-thistle, cleavers.
6. WHEN USED: 2-5 leaf stage for spring wheat, barley and oats. For winter wheat apply in spring when wheat is 15-25 cm tall or before shot blade stage. Best results will be obtained on hemp-nettle, corn spurry and cow cockle if application is made at the 2-3 leaf stage of the weeds.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: 510 mL/ac
   Water Volume: Air - 8 L/ac minimum. Ground - 45 L/ac.
   Pressure: Air - not above 200 kPa. Ground - 275 kPa.
8. APPLICATION TIPS: • Best under good growing conditions and air temperature 10-25°C. • Avoid application when crop is under stress from disease or adverse environmental conditions. Do not spray if rain is expected within 4 hours of application. Avoid application if frost or severe drop in night temperature is forecast. • To prevent drift to sensitive crops, do not spray if temperatures are expected to exceed 30°C, when humidity is high, or fog is present. • Crop damage can occur if the chemical is applied at any time other than the recommended crop stage. • Shortening of straw may occur without loss in yield.
9. HOW IT WORKS: DyVel is a systemic herbicide that is absorbed through the roots and leaves and translocated readily.
10. EXPECTED RESULTS: ***Weeds:*** Twisting, bending of main stem and leaf petioles, cupping of leaves or increase in root size occur within 10-14 days. ***Poor results may be expected if:*** it rains within 4 hours of application, or when older weeds are sprayed, or if less than recommended water volume is used.
11. EFFECTS OF RAINFALL: Rainfall 4 hours after application will not reduce effectiveness.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze or harvest for livestock feed prior to crop maturity.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = dicamba (1,707-2,900), MCPA (700). Non-toxic to birds, fish, and bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to cut down on exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). May cause some swelling to eyes. IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Protect from freezing but if frozen no activity is lost if completely resuspended.

2,4-D (amine, LV esters)

Numerous Manufacturers

1. FORMULATIONS: Liquids - Amines, LV esters. ***Amine 500*** - Amsol; 2,4-D Amine (500, 80); Estemine 2,4-D; Dy-Amine; No-Weed 2,4-D. 470 g/L. 4 L, 2 X 10 L, 20 L containers. ***LV Ester 500*** - SEE-2,4-D; 450 g/L; 2 X 10 L pack. ***LV Ester 600***- 2,4-D LV Ester (600, 96); No-Weed 2,4-D; 564 g/L; 2 X 10 L pack. ***LV Ester 700*** - 2,4-D LV Ester 700; 700 g/L; 20 L pails.

2. REGISTERED MIXES: ***2,4-D Amine*** - atrazine, atrazine + dicamba + mecoprop, bromoxynil, dalapon, dicamba, dicamba + mecoprop, mecoprop, metolachlor, picloram, sodium TCA. ***2,4-D Ester*** - bromoxynil, dicamba, dicamba + dichlorprop, dichlorprop, difenzoquat, propanil, sodium TCA. **NOTE:** Some formulations can be mixed with liquid fertilizer (28-0-0).

3. CROPS:

alfalfa(except Flemish types)
asparagus
barley (9.0)
clovers (except sweet)
corn
flax (emergency only)*
grasses
non-crop areas
oats (emergency only)*
pasture (grass)
rangeland
rye (fall, spring)
turf (established)
wheat, spring (8.7)
wheat, winter (9.0)

*Use only if crop is heavily infested with MCPA resistant weeds; crop injury may occur.

4. WEEDS CONTROLLED: **NOTE:** First rating amine; second rating ester.

bluebur
burdock
cocklebur
clover, sweet
flixweed (7.8)(7.8)
hawk's-beard, narrow-leaved
kochia (5.7)(6.8)
lamb's-quarters (7.7)(8.0)
lettuce, prickly
mustard (8.0)(8.0) (ball, hare's-ear, Indian, tumble, wild, wormseed)
pigweed, Russian (7.0)
plantain, common
radish, wild
ragweeds (common, false, giant)
shepherd's-purse (8.6)(8.0)
spurge, thyme-leaved
stinkweed (8.1)(8.0)
sunflower, wild
vetch

More Resistant Weeds:
dock, curled
false flax, small-seeded
galinsoga, hairy
goat's-beard
goosefoot, oak-leaved
lady's-thumb
mustards (dog, tansy)
purslane, common
peppergrass (common, field)
pigweed (prostrate, redroot, tumble)
pineappleweed
smartweeds, annual
thistle, Russian

5. WEEDS SUPPRESSED: Top control or suppression

alfalfa
bindweed (field, hedge)
buckwheats (Tartary, wild)
buttercup, creeping
dandelion
gumweed
hoary cress
horsetail, field
knapweed, Russian
lettuce, blue
sow-thistles (annual, perennial)
spurge, leafy
thistle, Canada
wormwood, biennial

6. WHEN USED: ***Alfalfa and Grasses (established):*** before growth of crop begins in spring. ***Alfalfa and Clovers (seedling):*** Up to 10 cm tall. ***Grasses (seedling):*** 3 leaf to just before flag leaf. ***Asparagus:*** just before first spears appear. May be repeated at end of cutting season. ***Barley, Rye, Spring Wheat:*** 3 leaf expanded to just before flag leaf. ***Fall Rye, Winter Wheat:*** early spring, before flag leaf. ***Cereals Underseeded to Legumes:*** at about 2nd true leaf of legumes. ***Corn:*** up to 15 cm tall; 15-20 cm tall, use drop nozzles to keep spray off corn. ***Flax (Emergency Use Only; MCPA preferred):*** after 5 cm to early pre-bud. ***Oats (Emergency Use Only; MCPA preferred):*** up to 3 leaf; 6 leaf to early flag leaf.

7. HOW TO APPLY:

With: Aircraft or Ground equipment.

Rate:

	FORMULATION AND CONCENTRATION (Quantity/ac)			
Crop	**Amine 500**	**Ester 500**	**Ester 600**	**Ester 700**
Alfalfa + Grasses (e .b.)	445-910 mL	-	325-610 mL	-
Grasses (seedling)	200-445 mL	-	-	-
Alfalfa + Clovers (seedling)	200-285 mL	-	-	-
Asparagus	140 mL	-	-	-
Barley, Rye, Wheat	285-445 mL	170-470 mL	210-385 mL	190-345 mL
(More resistant weeds)	505-710* mL	465-750* mL	375-610* mL	375-445* mL
Cereals Underseeded to Alfalfa	140 mL	-	-	-
Cereals Underseeded to Clovers	up to 285 mL	-	-	-
Corn	200-445 mL	-	285 mL	-
Flax (Emergency only)	285-710** mL	-	285 mL	-
Non-crop Areas	0.7-2.3 L	1.2-1.9 L	1.5 L	1.3-2.5 L
Oats (Emergency only)	285-710 mL	-	210-610 mL	-
Pasture, Rangeland, Turf	0.81-1.7 L	0.75-2.1 L	0.61-1.1 L	0.61-1.0 L

NOTE: *Higher rates can be used if weed infestation is high, but some crop injury may occur.
**Rates over 607 mL/ac may cause a delay in maturity.

Water Volume: Aircraft - 12 L/ac minimum. Ground - Barley, corn, oats, rye, wheat: 40-80 L/ac; Flax: 45-70 L/ac recommended; Legume seedlings: 60-80 L/ac; Pasture, rangeland, turf: 182 L/ac.
Pressure: Air: 235 kPa or less; Ground 200-275 kPa.

8. APPLICATION TIPS: • Recommendations vary from label to label, READ LABEL of product used. • Do not use on Flemish types of alfalfa, sweet clover, sanfoin, bentgrasses, or freshly seeded turf. • Spray during warm weather when the weeds are young and growing actively. At high temperatures vapourization of more volatile esters may cause injury to susceptible plants.
9. HOW IT WORKS: This hormone type herbicide causes abnormal growth, and affects respiration, food reserves and cell division in broadleafed plants. Absorbed primarily by leaves and stems and translocated to the growing tips and roots.
10. EXPECTED RESULTS: Susceptible plants become malformed before they die.
11. EFFECTS OF RAINFALL: A rain free period of 2 hours for esters, 4 hours for amine and 6 hours for salts.
12. MOVEMENT IN SOIL: Leaching does not pose a problem.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze for at least 24 hours after treatment.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (300-1,000). Some formulations may cause skin irritation. Some formulations are toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF AMINE formulations SWALLOWED - induce vomiting (see page 6). IF ESTER formulations SWALLOWED - do NOT induce vomiting. In all cases, get medical attention.
16. STORAGE: Do not freeze amine, if frozen warm to 4°C and mix thoroughly before using.

2,4-D (LV ester)
(Industrial)
Dow/May & Baker/Union Carbide

1. FORMULATIONS: Emulsifiable Concentrate. Low volatile ester; 570 g/L. Estasol LV600 - 8 L jug; Esteron 600 - 20, 205 L drum; No Weed 2,4-D - 10 L jug; 2,4-D Ester LV600 - 20 L pail.
2. REGISTERED MIXES: bromacil, dicamba, dicamba+dichlorprop, dichlorprop, fenoprop, monuron, picloram, sodium TCA. ***Mixing Restrictions:*** Carriers - water, oil. Use only diesel oil No. 1 or No. 2 fuel oil or kerosene where oil is recommended. When using oil carriers do not allow water to get into product or spray tank. (Oil mixes are very expensive, use may be limited to small areas during the dormant season.) Add 1/3 of the carrier, start agitation, add herbicide, then remainder of the carrier.
3. CROPS: Industrial and forestry locations. To control unwanted vegetation.
4. WEEDS CONTROLLED: ***Brush:*** Alder, birch, cherry, elm, hazelnut, maple (Manitoba), poplar (balsam, trembling aspen), snowberry (western), sumac, willow. ***Weeds:*** Common broadleaf weeds.
5. WEEDS SUPPRESSED: Canada thistle, field bindweed.
6. WHEN USED: ***Foliar Treatment:*** after foliage is fully developed. ***Stump Treatment:*** On freshly cut stump any time including winter. ***Basal Bark Treatment:*** Any time. Do not cut for 1 year after application.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: ***AIRCRAFT: - Brush Control:*** 6.6 L in 30 L of spray solution. ***Snowberry, willows:*** 1.33 L/ac. ***GROUND - Foliar Treatment:*** 8 L in 1000 L of water, ***Stump Treatment:*** 30 L in 1000 L of diesel oil, fuel oil, or kerosene. ***Basal Bark Treatment:*** 20-30 L in 1000 L of diesel oil, fuel oil, or kerosene. ***Frill Treatment:*** 30 L in 1000 L oil. ***Broadleaf Weeds:*** 405 mL/ac-1.6 L/ac.
   Pressure: Aircraft - 235 kPa or less. Ground - up to 1700 kPa.
8. APPLICATION TIPS: • Wet all foliage and stems to point or runoff. • Spray during warm weather when weeds and brush are actively growing. • Continuous agitation is required for the oil-water mixture. • Do not apply by air in dead-calm conditions as the "cloud" of suspended droplets may drift when wind comes up.
9. HOW IT WORKS: Absorbed through leaves and bark in trees. A hormone type herbicide causing an abnormal growth.
10. EXPECTED RESULTS: Brown crisp leaves first appear then death.
11. EFFECTS OF RAINFALL: A rain free period of 4-6 hours.
12. MOVEMENT IN SOIL: Minimal soil movement. 30 day half-life.
13. GRAZING AND CROPPING RESTRICTIONS: Use only on established turf grasses except creeping grasses such as bentgrass. Avoid spray drift.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (300-1,000). Some formulations may cause skin irritation. Toxic to fish and should not be introduced into aquatic environments.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting; see a doctor immediately.
16. STORAGE: Store away from fertilizers, seeds, insecticides, fungicides or other herbicides intended for use on 2,4-D sensitive crops. If frozen, bring to room temperature before using.

EMBUTOX 625; 2,4-D BUTYRIC 400; COBUTOX 400 (2,4-DB)

May & Baker/Pfizer/Federated Co-op

1. FORMULATIONS: Emulsifiable Concentrate; 400 g/L; 4 L, 20 L containers. Embutox 625; 625 g/L; 8 L jugs.
2. REGISTERED MIXES: Embutox 625 + Asulox F; Embutox 625 + MCPA (K, Na Salts). Cobutox 400 + MCPA amine. 2,4-D Butyric 400 + MCPA. ***Mix Restrictions:*** Add Asulox F to water, agitate, then add Embutox 625.
3. CROPS: Alfalfa (8.0), barley (9.0), bird's-foot trefoil, clovers (alsike, white)(8.9), corn (field), legumes (seedlings only), oats (8.2), pastures (9.0), wheat (spring)(8.8).
4. WEEDS CONTROLLED:

buckwheat, wild (5.7)	lady's-thumb	pigweed, redroot	smartweeds, green (5.4)
cocklebur	lamb's-quarters (8.4)	plantain	stinkweed
dock, curled (8.0)	mustard (ball, wild*,	ragweed	thistle, bull
goose-foot, oak-leaved	wormseed) (5.8)	shepherd's-purse	yellow rocket
hawk's-beard, narrow-leaved*			

* ***For better control use Embutox 625 + MCPA or 2,4-D Butyric 400 + MCPA.***

5. WEEDS SUPPRESSED: Canada thistle, field bindweed, perennial sow-thistle, dandelion and horsetail.
6. WHEN USED: ***Weeds*** - 1-3 leaf (seedling) stage. ***Legumes***: Seedling alfalfa, bird's-foot trefoil - 1-4 trifoliate leaf. Seedling white, alsike clover - after the first trifoliate leaf. ***Cereals*** - 5th leaf to early flag leaf. ***Field Corn*** - after crop is 38 cm high but before the beginning of tasselling. ***Pastures*** - after cutting or grazing, and before regrowth is 7.5 cm tall.
7. HOW TO APPLY:
   With: Ground equipment
   Rate: 1.0-1.7 L/ac; Embutox 625: 0.7-1.1 L/ac. Maximum on cereals, legumes, corn 1.4 L/ac; Embutox 625: 0.9 L/ac. Maximum on pastures 1.7 L/ac; Embutox 625: 1.1 L/ac. Control of narrow-leaved hawk's-beard rosettes in fall after legume growth has ceased: 1.7 L/ac.
   Water Volume: 60-80 L/ac
   Pressure: 275 kPa
8. APPLICATION TIPS: • Damage to forage legumes (especially to established alfalfa) may occur and increase in severity the longer treatment is delayed beyond stage recommended.
   • Do not spray in drought conditions.
   • Oats are sensitive if treated before the 5 leaf stage.
   • For better wild mustard control - tank mix Embutox 625 or Cobutox 400 with MCPA salt for use on seedling alfalfa and bird's-foot trefoil - some crop stunting may occur.
9. HOW IT WORKS: Susceptible plants convert 2,4-DB to 2,4-D. Certain legumes do not convert it. 2,4-DB is translocated to actively growing parts.
10. EXPECTED RESULTS: Weeds should die within 2-3 weeks of treatment.
11. EFFECTS OF RAINFALL: Rainfall before the foliage has dried from the spraying may decrease activity.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: No grazing restrictions.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,960). Toxic to fish. Non-toxic to birds and bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: If Cobutox 400 freezes it can be reactivated by warming to 20-22°C and agitating thoroughly. Do not freeze 2,4-D Butyric 400. Embutox 625 does not require heated storage.

EPTAM (EPTC)

Chipman

CAUTION POISON

1. FORMULATIONS: Emulsifiable Concentrate; Eptam 8-E; 800 g/L; 20 L can. Granular; Eptam 10-G; 10%; 20 kg bag.

2. REGISTERED MIXES: Eptam 8-E - Lexone or Sencor (Irish potatoes), liquid or granular fertilizers (except nitrate based ones).

3. CROPS: Alfalfa (9.0), bird's-foot trefoil, dry beans (7.6), snap beans (8.6), flax (7.5), Irish potatoes (9.0), sunflowers (7.9), turnips (rutabagas) (8.0), sugar beets (8.3)(Eptam 8-E only). ***Underseeding:*** Not recommended.

4. WEEDS CONTROLLED:

barley, volunteer (8.6)	grass, barnyard (8.6)	oats [volunteer, wild (8.1)]	quackgrass
bluegrass, annual (7.2)	henbit	pigweed [prostrate,	ryegrass, Italian (8.4)
chickweed, common	lamb's-quarters (6.4)	redroot (6.3), tumble]	spurry, corn (9.0)
foxtail [green (7.7), yellow (8.4)]	nightshade, hairy (8.5)	purslane	wheat, volunteer (6.9)

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***Alfalfa, Bird's-foot Trefoil (Seedings):*** Pre-planting. Do not use if seeding a grain or grass nurse crop. ***Beans, Snap or Dry (including Red Kidney):*** Pre-planting. Do not use on cow peas; or Adzuki, soy, lima, or other flat podded beans except Romano. ***Flax, Sunflower:*** Spring - Pre-planting. Do not apply in spring to soils with less than 3% organic matter. Fall - Before freeze-up. Cultivate lightly to destroy any overwintering rosettes in spring, before seeding. ***Potatoes:*** Incorporate in the fall or spring, after pre-emergence cultivation, or before the last cultivation. Eptam 8-E can also be metered into sprinkler irrigation equipment (READ LABEL for instructions). ***Turnips:*** Apply and incorporate 6-10 days before planting. ***Sugar Beets:*** In sprinkler irrigation water. **NOTE:** Fall application should not be used in areas where soil drifting is a hazard.

7. HOW TO APPLY:

With: Ground equipment or irrigation water.

Rate:

Crop	Eptam 8-E L/ac	Eptam 10G kg/ac	Crop	Eptam 8-E L/ac	Eptam 10G kg/ac
Alfalfa, bird's-foot trefoil.	1.7	13.8	Potatoes (pre-plant, pre-emergent)	1.7-3.4	13.8-27
Beans (dry, snap) (See exceptions in When Used)	1.7-2.2	13.8-18.2	Potatoes (post-emergent)	1.7-2.2	13.8-18.2
			Potatoes (sprinkler)	1.7-2.2	-
Flax (spring; sandy soil)	1.4	11.3	Potatoes (fall)	2.2-3.4	-
Flax (spring; clay soil)	1.7	13.8	Sunflowers (spring)	1.7	13.8
Flax (fall; sandy soil)	1.7	13.8	Sunflowers (fall)	1.7-2.2	13.8-18.2
Flax (fall; clay soil)	2.2	18.2	Turnips (sandy soil)	1.3	9.1
(Do not use south of Highway 1 in Alberta)			Turnips (clay soil)	1.7	13.8
			Sugar beets (sprinklers)	1.1-1.7	-

Water Volume: 45 L/ac minimum.

Incorporation: Incorporate immediately. Second incorporation must be at right angles to the first. Power-driven cultivation equipment, set to cut 5-7.5 cm deep. Tandem, one way discs, set to cut 10-15 cm and operate at 6.5-9.5 km/h followed by harrows. Field cultivators, for lighter soils in good tilth. Use 3-4 rows of sweeps spaced no wider than 18 cm. Cut 10-15 cm deep at 9.5 km/h. Pull harows behind cultivator.

Pressure: 275 kPa

8. APPLICATION TIPS: • For use on mineral soils only. • When applying Eptam 8-E with granular fertilizer, a minimum of 81 kg/ac and a maximum of 324 kg/ac of fertilizer is required. See product label for further instructions. • ***Flax, Special Instructions:*** Seed shallow, less than 3 cm, into a firm seedbed. Deep seeding reduces stands.

9. HOW IT WORKS: Taken up by the roots and shoots of a germinating weed where it disrupts and stops further growth.

10. EXPECTED RESULTS: ***Weeds:*** Absorbed by the weed shoot, therefore, most affected weeds will not emerge. Numerous chlorotic and bleached shoots may be visible by removing the top few inches of treated soil. Provides effective weed control for approximately 6-8 weeks. ***Crops:*** If crop seedlings are weak, some injury may occur.

11. EFFECTS OF RAINFALL: Very soluble in water so excessive moisture may cause leaching.

12. MOVEMENT IN SOIL: Eptam will move readily in the soil.

13. GRAZING AND CROPPING RESTRICTIONS: No grazing or cropping restrictions. ***Harvest Restriction:*** Pre-harvest interval (days) after treatment - potatoes (45). ***Succeeding Crops:*** no restrictions.

14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,600). Very toxic to fish. Non-toxic to birds.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Heated storage not required. Store away from seed and fertilizer.

ERADICANE 8-E (EPTC)

Chipman

1. FORMULATIONS: Emulsifiable Concentrate; 800 g/L; 20 L can.
2. REGISTERED MIXES: Atrazine (80W or F), liquid fertilizer, granular fertilizer, urea and urea blends. ***Mix Restrictions:*** check compatability.
3. CROPS: Corn (field, sweet) (9.0)
4. WEEDS CONTROLLED:

barley, volunteer (7.0)	foxtail [green (8.4), yellow]	oats (volunteer, wild)(8.1)	quackgrass
bluegrass, annual	henbit	pigweed (prostrate, redroot,	ryegrass, Italian
chickweed, common	lamb's-quarters (9.0)	tumble)(6.6)	spurry, corn
grass, barnyard (8.7)	nightshade, hairy	purslane	wheat, volunteer (9.0)

5. WEEDS SUPPRESSED: None.
6. WHEN USED: Apply, incorporate, and seed corn as soon as possible.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: Corn (field, silage) - 1.7-3.4 L/ac. Sandy soils 1.7 L/ac; Clay soils 2.2 L/ac; Quackgrass control 3.4 L/ac. Corn (sweet) - 1.7-2.2 L/ac. Annual weed control only, do not exceed 2.2 L/ac.
   Water Volume: 45 L/ac minimum.
   Incorporation: Within minutes of application. Use power-driven cultivation equipment, set to cut 5-7.5 cm deep or discs set 10-15 cm - both these types of equipment should operate at 6.5-9.5 km/h. A second working, at right angles to the first will provide adequate mixing.
   Pressure: 275 kPa
8. APPLICATION TIPS: Proper soil coverage and immediate and adequate soil mixing are important.
9. HOW IT WORKS: Absorbed by roots and shoots of a germinating weed, disrupts and stops growth and causes eventual death.
10. EXPECTED RESULTS: ***Weeds:*** Affected weeds do not emerge, chlorotic and bleached shoots are visible by removing a layer of treated soil. ***Crops:*** Weak seedlings may be injured. ***Poor results may be expected if:*** soils are wet, cloddy and trashy; not suitable for proper application or incorporation.
11. EFFECTS OF RAINFALL: Very soluble therefore, excessive moisture may cause leaching.
12. MOVEMENT IN SOIL: Will move readily.
13. GRAZING AND CROPPING RESTRICTIONS: No restrictions on grazing, crop use after hail nor on succeeding crops. Danger from drift is low. **Caution:** Excessive incorporation required may cause erosion on some soil.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,600).
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention immediately.
16. STORAGE: Heated storage not required.

ESTAPROP (2,4-D + dichlorprop)

May & Baker

1. FORMULATIONS: Emulsifiable Concentrate; 282 g/L 2,4-D ester isomer specific + 300 g/L dichlorprop; 8 L container.
2. REGISTERED MIXES: Avenge. See Avenge label for restricted wheat varieties.
3. CROPS: Barley (8.1), wheat [spring (8.2), winter (9.0)]. ***Underseeding:*** legumes not recommended.
4. WEEDS CONTROLLED:

bluebur (9.0)	goosefoot, oak-leaved	pigweed (redroot,	sow-thistle, annual
burdock	kochia (7.5)	Russian)	sunflower, volunteer
buckwheat	lady's-thumb	ragweeds	stinkweed (9.0)
[Tartary, wild (7.4)]	lamb's-quarters (7.8)	rapeseed, volunteer	stork's bill (6.9)
catchfly, night-flowering	mallow, round-leaved	shepherd's-purse	thistle, Russian
cocklebur	mustard (ball, dog, wild, Indian, tumble,	smartweeds (7.8)	
flixweed	hare's ear, wormseed)(8.6)		

5. WEEDS SUPPRESSED: Canada thistle (5.6), curled dock, perennial sow-thistle.
6. WHEN USED: Spring seeded crops - 4 leaf to early flag leaf. Fall seeded crops - full tillering to flag leaf, apply only in spring. Early spraying of stork's bill, round-leaved mallow and kochia gives good control.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: 710 mL/ac
   Water Volume: 20-80 L/ac
   Pressure: 275 kPa
8. APPLICATION TIPS: Crops under stress from adverse environmental conditions such as excess moisture, drought, or disease may suffer a further setback when Estaprop is applied; however, the crop injury that may occur is usually offset by weed control obtained.
9. HOW IT WORKS: A systemic herbicide absorbed by leaf and stem.
10. EXPECTED RESULTS: Twisting and curling of weeds will commence 2-10 days after application. Growth ceases, eventually plants turn brown and die. ***Poor results may be expected if:*** • Poor coverage. • Low relative humidity during and after spraying.
11. EFFECTS OF RAINFALL: Rain within 3 or 4 hours of application may reduce control.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: Drift over susceptible crops will cause injury. No grazing until 14 days after application.
14. TOXICITY: Moderate acute mammalian toxicity. oral LD_{50} rats (mg/kg) = 2,4-D (300-1000), dichlorprop (800). Toxic to bees. Contains no harmful dioxin.
15. PRECAUTIONS, FIRST AID: Do not spray on foraging bees. Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attentions.
16. STORAGE: May be stored at any temperature. Shake well after storing for 1 year or longer.

ESTAPROP (Industrial), SILVAPROP 700 (2,4-D + dichlorprop)

May & Baker

WARNING POISON

1. FORMULATIONS: Emulsifiable Concentrate; - Estaprop; 282 g/L 2,4-D ester isomer specific + 300 g/L dichlorprop; 8 L jug. - Silvaprop 700; 329 g/L 2,4-D ester + 350 g/L dichlorprop; 20 L containers.
2. REGISTERED MIXES: DyCleer, fuel oil (basal, frill, stump treatments). ***Mix Instructions:*** Add 1/2 amount of carrier, start agitation, add herbicide, then add the rest of carrier. Forms an emulsion in water - agitate to prevent separation. If used in oil, do not let water get in mixture.
3. CROPS: Non-crop areas, industrial areas, rights of way, roadsides.
   Underseeding: Not applicable.
4. WEEDS CONTROLLED:

Brush - Group 1	Group 2		
cedar, white	alder	fir, balsam	pine (red, Scotch)
cherry, wild	apple, wild	hardhack	poison-ivy
hawthorn	aspen	hazel	raspberry, tame
maple, sugar	basswood	hickory	sumac
pine, Scotch	birch	honeysuckle	tamarack
plum, wild	blueberry	juniper, ground	willow
poplar	elderberry	maple (Manitoba, silver)	
raspberry, wild	elm	oak (bur, white)	
Weeds (also weeds listed for Estaprop on barley and wheat)			
alfalfa	clover, sweet	hawkweed	teasel
burdock	dandelion	horsetail	thistle (bull, Canada)
buttercup	dock, curled	mullein	vetch
carrot, wild	dogbane	plantain	yellow rocket
chicory	goat's-beard	sow-thistle, perennial	
cinquefoil	goldenrod	tansy	

5. WEEDS SUPPRESSED: milkweed, rose, sugar maple, toadflax
6. WHEN USED: ***Brush Control*** - apply on foliage and stems just prior to or just after brush is in full leaf in late spring or early fall. Many species may require retreatment the following year. ***Basal Treatment (not ash or basswood)*** - any time of year. ***Frill Treatment*** - standing trees more than 13-15 cm in diameter. ***Stump Treatment*** - immediately after cutting. ***Weeds*** - during May or in early fall. Some species may require a second treatment.
7. HOW TO APPLY:
   With: Aircraft, power equipment, knapsack sprayer.
   Rate: ***Brush Control (rate/1000 L of water)***- Group 1 (see Weeds Controlled) - Estaprop 8.75 L; Silvaprop 7.5 L. Group 2 - Estaprop 11.7 L; Silvaprop 10.0 L. ***Basal (not ash or basswood)(rate/100 L of fuel oil)*** - Group 1 - Estaprop 3.25 L; Silvaprop 2.8 L. Group 2 - Estaprop 5.1 L; Silvaprop 4.4 L. ***Frill/Stump Treatment (rate/100 L fuel oil)*** - Estaprop 3.25 L; Silvaprop 2.8 L. ***Weeds*** - Estaprop 1.6 L/ac; Silvaprop 1.4 L/ac.
   Water Volume: ***Aircraft (fixed wing)*** - 8 L/ac minimum. ***Ground*** - Brush Control 305-610 L/ac depending on brush density and height. Weeds 80-240 L/ac, spray to point of runoff.
   Pressure: As recommended for equipment used.
8. APPLICATION TIPS: • Thoroughly wet down all foliage and stems to ground level. • Do not spray during high winds or high temperatures.
9. HOW IT WORKS: A translocated, systemic herbicide absorbed by leaves.
10. EXPECTED RESULTS: Leaves brown and wilt shortly after spraying - no leaves appear the following year.
11. EFFECTS OF RAINFALL: Rain within 3 or 4 hours after application may reduce control.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: No grazing restrictions. ***Drift*** over susceptible crops causes injury.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = 2,4-D (300-1000); dichlorprop (800). Toxic to bees. 2,4-D present contains no dioxin.
15. PRECAUTIONS, FIRST AID: Do not apply when bees are foraging. Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: If frozen, warm to 5°C and mix well.
    NOTE: Similar products, Desormone LV700/Dipenoprop 700, are listed on page 36.

FORTRESS (triallate + trifluralin)

Monsanto

1. FORMULATIONS: Granular; 10% triallate + 4% trifluralin; 22.7 kg bag.
2. REGISTERED MIXES: None.
3. CROPS: Barley, flax, mustard, rapeseed (including canola), wheat (durum, spring).
4. WEEDS CONTROLLED: Green and yellow foxtail, wild oats.
5. WEEDS SUPPRESSED: None.
6. WHEN USED: Apply in fall, after September 15 until soil freeze-up. Applications made before September 15 may result in reduced control. Spring application not recommended.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate:

	Soil Organic Matter				
Crop	**Less than 2%**	**2 - 4%**	**4 - 6%**	**Greater than 6%**	**Seeding Depth**
	kg/ac	**kg/ac**	**kg/ac**	**kg/ac**	**cm**
Barley	4.5	5.7	5.7	6.9	5-7.5
Flax, mustard, rapeseed.	5.7	5.7	5.7	6.9	as desired
Wheat (durum, spring)	-	4.5	5.7	5.7	5-7.5

   Incorporation: ***Time:*** 1st incorporation within 24 hours, second incorporation can be either in the fall or spring. ***Implement:*** Use a double disc or light duty cultivator plus harrows. Harrowing does not provide effective incorporation if compacted soil prevents penetration of harrow teeth or if trash accumulates in harrow section or if harrows bounce.
8. APPLICATION TIPS: • Calibrate equipment to deliver desired amount of product. • Use only a hoe-drill or a double disc press drill to seed barley or wheat into a Fortress treated field. • Do not apply to soil with less than 2% organic matter if it is to be seeded to wheat. • Do not apply Fortress for wheat on land which has been treated with trifluralin since June 1 of the previous year. ***Seeding:*** Flax, mustard, and rapeseed can be seeded in treated layer. • Barley and wheat are more sensitive and should be planted 6.0-7.5 cm. Wheat must be seeded at least 1.0 cm below the treated layer. Do not seed deeper than 7.5 cm. • To ensure an even crop stand, increase the usual seeding rate of barley and wheat by 10%.
9. HOW IT WORKS: Absorbed by wild oat shoots and foxtail roots usually resulting in death before emergence. Under dry conditions, some wild oats and foxtail may emerge before being killed.
10. EXPECTED RESULTS: ***Weeds:*** Wild oats and foxtail die before they emerge. Weed control may be reduced under conditions of prolonged, cool soil temperatures at the time of germination, or extreme drought in spring. ***Crops:*** Thinning in barley and wheat are known to occur under conditions of heavy rainfall and/or cold weather after application and before crop emergence. In most cases thinning is more than offset by tillering. Some thinning may be noted on eroded knolls. ***Poor results may be expected if:*** there is incomplete incorporation due to wet, cloddy soil or heavy trash. Very dry soil conditions in spring or prolonged cool soil temperatures at time of germination. Ridges left by seeding may disrupt the treated layer and allow escapes.
11. EFFECTS OF RAINFALL: Moisture is required for activation. Rainfall of at least 1.5 cm within 2 weeks of application, in the spring, is required to ensure maximum performance.
12. MOVEMENT IN SOIL: Negligible.
13. GRAZING AND CROPPING RESTRICTIONS: No grazing restrictions. ***Succeeding Crops:*** Domestic oats, sugar beets, and small seeded annual grasses such as timothy, canary seed, and creeping red fescue should not be grown in rotation following a Fortress treated crop.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (greater than 5,000). May cause skin and eye irritation.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid getting chemical on skin or in eyes. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in a dry place.

GLEAN (chlorsulfuron)

DuPont

1. FORMULATIONS: Dry Flowable; 75%; 500 g container.

2. REGISTERED MIXES: Avenge 200-C, Avenge 640, Hoe-Grass 284, Mataven, Roundup, Stampede 360, Surfactants (Ag-Surf, Agral 90, Citowett Plus). ***Mix Instructions:*** Add 1/2-3/4 required amount of water. While agitating, ***add Glean and ensure it is completely suspended before adding tank mix herbicide.*** Complete filling, then add surfactant (IF REQUIRED). Continuous agitation is required.

3. CROPS: Barley (9.0), oats, non-crop areas, wheat (9.0)(durum, spring, winter).

4. WEEDS CONTROLLED:

Crops 6 g/ac		**Crops 12 g/ac**	
cockle, cow (9.0)	mustard, wild (8.0)	thistle, Russian (6.2)	kochia
flixweed	pigweed, redroot (8.5)	buckwheat, wild (7.7)	shepherd's-purse
hemp-nettle (8.3)	rapeseed, volunteer (8.1)	cleavers (8.2)	(fall fallow)
lady's-thumb	smartweeds, green (8.3)	chickweed, common (8.6)	
lamb's-quarters	stinkweed (8.2)	dandelion (fall fallow)	

Non-crop areas 28 g/ac	**Non-crop areas 49 g/ac**		
carrot, wild	carrot, wild	kochia	thistle
clover, sweet	clover, sweet	hawk's-beard,	(Canada, Russian)
kochia	dandelion	narrow-leaved	
		horsetail	

5. WEEDS SUPPRESSED: **Crops 12 g/ac** - Canada thistle (6.6), green foxtail (fall fallow).
Non-crop areas 28 g/ac - Canada thistle, dandelion, goldenrod, horsetail, perennial sow-thistle, wild rose, wild strawberry.
Non-crop areas 49 g/ac - Goldenrod, perennial sow-thistle, wild rose, wild strawberry, willow.

6. WHEN USED: ***Barley, oats, wheat [durum, spring, winter (spring application)]*** - 2 leaf to flag leaf stage. ***Chemical Fallow (preceding wheat)*** - Glean+Roundup; post-harvest prior to fallow or in spring during fallow. ***Fall; prior to planting spring wheat (excluding durum)*** - brown and dark brown soil zones. ***Reduced Tillage Fallow (preceding wheat)*** - brown and dark brown soil zones. Fall; post-harvest prior to fallow season. Spring; during fallow season. ***Non-crop areas*** - post-emergence to young actively growing weeds. Do not apply to frozen ground or to soils saturated with water or during periods of heavy rainfall. ***Weeds*** - best results when less than 10 cm tall and actively growing.

7. HOW TO APPLY:
With: Ground equipment. Do NOT apply by air.
Rate:

Herbicide(s)	**Crops**	**Glean g/ac**	**Tank Mix**	**Surfactant***
Glean alone	spring; barley, wheat	6 or 12	-	1 L/1000 L
Glean alone	fall; preceding wheat	8 or 12	-	spray mix
Glean alone	reduced tillage; preceding wheat	12	-	
Glean alone	non-crop areas; selective control	28	-	
Glean alone	non-crop areas; non-selective control	49	-	
+ Avenge 200-C	barley, Avenge wheat varieties	6 or 12	1.72 L/ac	NONE
+ Avenge 640	barley, Avenge wheat varieties	6 or 12	525 g/ac	NONE
+ Hoe-Grass 284	barley (except Klages, Betzes), wheat (durum, spring, winter)	6 only	1.1 L/ac	NONE
+ Mataven	only wheat (durum, spring)	6 or 12	2.0 L/ac	NONE
+ Roundup	chemical fallow; preceding wheat (durum, spring, winter)	12 only	300-400 mL/ac	140 mL/ac Ag-Surf/Agral 90
+ Stampede 360	barley (only Argyle, Bedford, Klages), wheat (durum, spring)	12 only	1.1 L/ac	1 L/1000 L spray mix

*=Ag-Surf, Agral 90, or Citowett Plus unless stated otherwise.
Water Volume: flat fan nozzles - 25 L/ac minimum; flooding fan nozzles - 91 L/ac.
Pressure: 275 kPa
Nozzles: Flat fan types. Increased water volumes for flooding fans. 50 mesh screens or larger. Only metal or nylon filters.

8. APPLICATION TIPS: • Higher spray volumes required for dense crop canopy and/or large weeds. • Effectiveness may be reduced if spray mixture remains in tank for more than 24 hours. Do not exceed a total of 12 g/ac within a 12 month period on crop land.
Sprayer Cleanup: To avoid injury to susceptible crops such as canola thoroughly clean sprayer immediately after spraying:
1. Drain and flush tank, boom and hoses with clean water for a minimum of 10 minutes.
2. Fill tank with clean water, add 0.5 L chlorine bleach (containing 5.25-6.0% sodium hypochlorite) per 100 L of water. Flush through boom and hoses, allow to sit for 15 minutes with agitation, drain.
3. Repeat step 2.
4. Nozzles and screens should be removed and cleaned separately. To remove traces of chlorine bleach, rinse tank thoroughly with clean water and flush through hoses and boom.
NOTE: Do NOT use chlorine bleach with ammonia. All traces of liquid fertilizer containing ammonia or ammonium nitrate or ammonium sulphate must be removed from application equipment before adding chlorine bleach solution. This can be done effectively by rinsing with water, failure to do so will result in a release of a gas with a musty chlorine odor which can cause eye, nose, throat and lung irritation. Do NOT clean equipment in an enclosed area.

9. HOW IT WORKS: Absorbed by foliage and roots. Inhibits cell division.

10. EXPECTED RESULTS: ***Weeds:*** growth stops almost immediately. After 7-10 days yellowing or purpling will occur followed by complete desiccation. Glean remains active in soil throughout the growing season controlling later germinating weeds. ***Poor results may be expected if:*** improper mixing, timing, coverage or when weeds are under drought stress.

11. EFFECTS OF RAINFALL: Heavy rainfall immediately after application may cause temporary lightening of crop.

12. MOVEMENT IN SOIL: Movement is restricted by fine textured soils, soil organic matter and neutral to acidic conditions.

13. GRAZING AND CROPPING RESTRICTIONS: ***Grazing restrictions:*** None. ***Drift:*** Use extreme care to prevent drift onto desirable plants or non-target agricultural land.
Succeeding Crops:
Recropping to barley, oats, wheat.

	Minimum Recropping Intervals (months)			
Soil pH*	**Barley**	**Oats**	**Wheat (durum)**	**Wheat (spring, winter)**
7.0 or lower	10	10	10	2
7.1 to 7.5	22	22	10	2

* Soil pH determined by 1:1 soil:water suspension method.

Rotation to Crops other than Cereals

		Minimum Rotation Interval (Months)			
Soil pH	**Soil Zone**	**Flax**	**Lentils**	**Peas**	**Rapeseed (canola)**
7.0 or lower	Black (organic matter greater than 5%)	48	48	34	22
	Dark Brown	-	-	-	34
	Brown	-	-	-	34
7.1 to 7.5	Black (organic matter greater than 5%)	-	-	34	34

NOTE: • If rainfall is less than 250 mm in the black or 130 mm in the brown or dark brown soil zones in any year between Glean application and planting of flax, lentils, peas, or rapeseed; extend rotation interval 1 year, unless a field bioassy confirms the absence of Glean residues. • Unless soil pH, soil zone, crop or minimum rotation is as specified as above, the completion of a successful field bioassay is required before planting a crop in Glean treated soil. • For crop rotation flexibility, do not use Glean on all of your crop land. • All cropping restrictions which apply to Glean alone will apply to wild oat herbicides + Glean tank mix.

14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,919).

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6).

16. STORAGE: Store in a cool, dry place.

GRAMOXONE (paraquat)

Chipman

1. FORMULATIONS: Solution; 200 g/L; 1, 4 X 5 L pack.
2. REGISTERED MIXES: None. ***Chemical Mowing of Non-Crop Areas:*** May be tank mixed with certain soil sterilants where immediate top kill and long-term sterilization are required.
3. CROPS: Asparagus, non-crop areas, potatoes, shelterbelts, stale seedbed (vegetables, field crops), sugar beets.
4. WEEDS CONTROLLED: All top growth. Generally kills annuals in 1 application. Repeat applications may be needed on perennials.
5. WEEDS SUPPRESSED: Most perennial weeds.
6. WHEN USED: Prior to crop emergence, but soon after weeds emerge. ***Potatoes:*** apply up to ground crack only for Netted Gem and Cherokee. Other varieties apply up until the first potato tops are 5-8 cm. Do not apply to emerged potato foliage in evening, or when potatoes are under moisture stress due to extremely dry soil conditions, or to early potatoes. ***Stale Seedbed:*** do not apply later than 3 days before crop emergence.
7. HOW TO APPLY:
   With: Ground equipment only. Do not use mist blowers.
   Rate: ***Chemical Mowing:*** 1.1 L in 220-445 L/ac of water. ***Non-Crop Areas:*** - 2.2-4.5 L in 220-445 L/ac of water. ***Potatoes:*** quackgrass, annual grasses and broad-leaf weeds - 1-1.75 L in 120-220 L/ac of water; emerged seedlings thereof - only 810 mL in 120-220 L/ac of water. **NOTE:** Application to exposed or emerged potato foliage will cause temporary injury and chlorosis. Use of poor or diseased seed and cut seed with 1 eye will make potatoes more susceptible to injury by post-emergence sprays. Will not control weeds that germinate after treatment. ***Shelterbelts:*** 2.2 L in 445 L of water/ac or 75 mL in 10 L of water/100 m^2. 550 mL of this mixture will treat an area 1.75 m in diameter around a tree. ***Stale Seedbed Technique (Vegetables, Field Crops):*** Beans (all types), beets, carrots, cole crops, corn, cucumbers, onions, peas, potatoes, soybeans, turnips. Prepare a seedbed at least 2-4 weeks before seeding to stimulate weed growth. Seed with minimum soil disturbance. Burn-off of emerged weeds - 1.1-2.2 L in 120-445 L of water/ac before or after seeding. Weeds above 5 cm tall - 2.2 L/ac.
   Water Volume: 120-445 L/ac. Thoroughly wet all foliage. For dense weed growth use the greater volume of water.
   Incorporation: Not applicable
   Pressure: 300 kPa
8. APPLICATION TIPS: • Use only clean water to avoid reduction in effectiveness. • Use high volume, low pressure type spraying equipment to thoroughly cover foliage. Special equipment is necessary to shield some row crops from spray. • Applications on cloudy days, or just prior to or during periods of darkness will generally increase effectiveness of the treatment. • Thoroughly wash equipment after spraying - use a wetting agent (Agral 90 at 60 mL/100 L of water), flush and spray out, then thoroughly rinse with clean water. Fill with clean water and leave overnight, then spray out.
9. HOW IT WORKS: Absorbed by leaves and stems, but does not translocate.
10. EXPECTED RESULTS: Provides immediate, fast and virtually complete annual weed kill from 1 application. Repeat applications may be necessary for perennial weeds. Yellowing occurs within a few hours and desiccation of the plant continues rapidly until death.
11. EFFECTS OF RAINFALL: Rain prior to spray solution drying on plant, or muddy water will reduce effectiveness of the chemical. Once spray solution has dried on plant tissue, rain will not reduce effectiveness.
12. MOVEMENT IN SOIL: Binds to the soil and becomes biologically unavailable. No residual effect.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Prevent drift onto crops, ornamentals, lawns, grazing areas, or other desirable areas. ***Grazing Restrictions:*** Not applicable ***Crop Use After Hail:*** and ***Succeeding Crops:*** No restriction.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (120). Symptoms of acute poisoning may occur. **May be fatal if swallowed.**
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4), goggles and respirator. KEEP OUT OF REACH OF CHILDREN AND ANIMALS. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). See a doctor immediately.
16. STORAGE: Heated storage preferred. Will crystallize if frozen. NEVER transfer to other containers.

HERITAGE (trifluralin)

Elanco

Wheat – Brown Soil Zones Only

1. FORMULATIONS: Granular; 5%; 25 kg bag.
2. REGISTERED MIXES: None
3. CROPS: Wheat (durum, spring)(8.6). ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED: ***Fallow Year:***

buckwheat, wild (8.3)	foxtail, green (8.1)	lamb's-quarters (8.0)	pigweed, redroot (8.2)
cockle, cow (9.0)	grass, barnyard (8.3)	oats, wild (7.5)	thistle, Russian
darnel, Persian			

Crop Year: Green foxtail, lamb's-quarters.

5. WEEDS SUPPRESSED: ***Crop Year:*** Wild buckwheat, wild oats.
6. WHEN USED: Apply to summerfallow in May, June and July for weed control during both years of a summerfallow-wheat rotation. Maximum benefit comes when applied as early as possible in the fallow year.
7. HOW TO APPLY:
   With: Ground equipment with granular applicator.
   Rate: May 8.9 kg/ac, June 7.7 kg/ac, July 6.5 kg/ac. Brown Soil Zones Only.
   Incorporation: If green growth prevents proper mixing, it must be destroyed before application. Apply over standing or pre-worked stubble, provided straw is chopped and evenly distributed. Incorporate within 24 hours of application to 5-8 cm with cultivator (field or deep tillage) at 10-13 km/h or disc at 7-10 km/h. Second incorporation at the same depth and right angles to first. Repeat when necessary to control resistant weeds in fallow year. Cultivation with a rodweeder or shallow tillage cultivator may be required. Do not cultivate when soil is crusted, lumpy or too wet for good mixing action. Working deeper than 8 cm can result in erratic weed control and crop injury.
8. APPLICATION TIPS: • Do not apply on soils subject to prolonged flooding, sandy soils with less than 1% organic matter, soils in poor working condition, soils with more than 8% organic matter. Application to severly eroded knolls may result in reduced crop stands. • In the fall, prior to application , spread straw evenly over field and leave stubble standing to trap snow. For maximum effectiveness apply in May. • After filling granular applicator, close lid quickly to avoid exposure to direct sunlight. • In crop year, after application and when soil is warm enough for good germination, prepare seedbed with field cultivator set at 5 cm deep. Seed into a weed-free seedbed, 3-6 cm deep, using double disc or hoe drill. Separate spring tillage may not be necessary with a discer or airseeder. Pack or harrow after seeding. • Drought conditions in fallow year, prior to seeding, may result in higher carryover of Heritage at seeding time. To reduce possible injury by carryover, seeding to the correct depth (3-6 cm) is critical.
9. HOW IT WORKS: Seedlings are killed during germination by inhibited cell division at active growing points. This results in puffy, brittle, slow growing shoots and swollen brittle root tips. Established weeds are not controlled.
10. EXPECTED RESULTS: ***Weeds:*** After first incorporation, susceptible weeds are partially controlled. After second operation, susceptible weeds are controlled before emergence. ***Crop:*** No injury to wheat, after summerfallow. Over-application caused by overlapping, improper calibration, non-uniform application, etc. may reduce crop stand, delay development or reduce yields.
11. EFFECTS OF RAINFALL: No effect once incorporated into the soil.
12. MOVEMENT IN SOIL: None.
13. GRAZING AND CROPPING RESTRICTIONS: None.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (10,000). Non-toxic to bees. Very toxic to fish. Large amounts of Heritage can be tolerated by fish in runoff or muddy water because it binds to suspended soil.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in areas not exposed to high temperatures, prolonged direct sunlight or moisture.

SPECIAL USE: on wheat [durum, spring (including semi-dwarf)] ONLY – Fall application ONLY.
Weeds Controlled: Green Foxtail.
When Used: Fall application only. September 1 to freeze up.
Incorporation: (as above) First incorporation within 24 hours of application, 5-8 cm deep. Second incorporation at same depth and right angles to first, in the fall at least 3 days later or in the spring during seedbed preparation.
Rate: 4.5 kg/ac.

HOE-GRASS II (diclofop-methyl + bromoxynil)

Hoechst

1. FORMULATIONS: Emulsifiable Concentrate; 230 + 80 g/L; 20 L.
2. REGISTERED MIXES: Decis, MCPA (Amine or Ester)**(only 28 mL/ac)**. **CAUTION:** Do not exceed, under any circumstances, the recommended amount of MCPA as a severe reduction in grassy weed control will result.
3. CROPS: Barley (8.4)(except Betzes, Klages), flax (7.6), rye (spring), triticale, wheat [durum, spring (8.7)]. ***Underseeding:*** Do not treat crops underseeded to legumes.
4. WEEDS CONTROLLED:

buckwheat	corn, volunteer (8.4)	knawel	oats, wild (7.4)
[Tartary (7.2) wild (8.0)]	darnel, Persian (7.0)	kochia (8.2)	pigweed, redroot (8.8)
catchfly, night-flowering (8.8)	foxtail [green, yellow (7.4)]	lady's-thumb	smartweed, green (8.8)
chamomile, scentless (8.7)	grass, barnyard (9.0)	lamb's-quarters (8.6)	stinkweed (8.2)
cockle, cow (7.9)	groundsel, common (9.0)	mustard, wild (8.3)	thistle, Russian (8.9)

5. WEEDS SUPPRESSED: None
6. WHEN USED: ***WEEDS*** - Barnyard grass, foxtail, wild oats: 1-4 leaf. Persian darnel: 1-3 leaf. Volunteer Corn: 15-25 cm. Broad-leaved weeds: seedling - early 4 leaf. Russian Thistle: seedling - 5 cm tall. ***CROPS*** - Barley (except Betzes, Klages): 1-4 leaf and prior to tillering. Application beyond the 4 leaf stage or after tillering will result in crop damage. Flax: 5-10 cm tall. Do not spray during high heat or humidity stress as it may cause leaf burn, retarded growth and a slight maturity delay.
7. HOW TO APPLY:
   With: Ground equipment only. Do not apply by air.
   Rate: 1.4 L/ac
   Water Volume: 45 L/ac
   Pressure: 275 kPa.
   Nozzles: Only flat fan nozzles recommended, tilt 45° forward to ensure better coverage.
8. APPLICATION TIPS: • For best results and maximum yield enhancement, apply when majority of weeds are in the 2-3 leaf stage. • During periods of stress (heat, drought or low humidity) reduced weed control may result. • Hoe-Grass II must be applied at least 4 days before the use of any other herbicide to eliminate a reduction of control.
9. HOW IT WORKS: Diclofop-methyl possesses contact as well as systemic action. Uptake is primarily through the leaves. The site of action is the growing point. Bromoxynil is primarily a contact herbicide with limited translocation in susceptible annual broadleaved weeds.
10. EXPECTED RESULTS: Yellowing of susceptible plants are visible within 2-4 days. New leaf growth exhibits light chlorosis which deepens and browning develops within 10-14 days of application. Photosynthesis and growth are inhibited and uptake of water and nutrients ceases. Lack of adequate crown root development is 1 of the most distinguishable features of diclofop-methyl activity. Bromoxynil activity is evident within 24 hours as necrotic spots appear on the leaves of susceptible broadleaved weeds. This damage spreads rapidly until the plants ultimately die. Chlorosis may develop in the untreated leaves of these susceptible weeds even though very little movement of the bromoxynil occurs. **Precautions:** ***Barley*** - Under certain environmental conditions, yellow blotches may appear on the barley leaves. These blotches will be rapidly outgrown and will not affect maturity or yield.
11. EFFECTS OF RAINFALL: Rainfall within 1 hour will decrease activity.
12. MOVEMENT IN SOIL: Some movement may occur if sufficient moisture is present.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Avoid treatment near susceptible crops. ***Grazing Restrictions:*** Do not graze treated field prior to harvest. Do not use treated field for green forage. Do not apply Hoe-Grass II within 60 days of harvest. ***Succeeding Crops:*** No restriction.
14. TOXICITY: Low acute mammalian toxicity; Acute oral LD_{50} rats (mg/kg) = (2,350). Eye irritant. Toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) plus goggles to reduce eye exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting but rush person to nearest hospital.
16. STORAGE: Do not store below freezing. If stored for 1 year or longer, shake well before using.

HOE-GRASS 284 (diclofop-methyl)

Hoechst

1. FORMULATIONS: Emulsifiable Liquid; 284 g/L; 20 L pack.

2. REGISTERED MIXES: Bladex TTC, Glean (6 g/ac only), Lontrel (405 mL/ac only), Pardner, Torch DS, Decis.
Mixing Restrictions: Do not use surfactants in Glean mix. Mixing with any broadleaf herbicide other than those registered on the Hoe-Grass 284 label will result in a reduction of grassy weed control.

3. CROPS:

barley (8.2)(except Klages, Betzes)
beans, dry common (8.8) (only black, pinto, white)
beans, snap
buckwheat, tame (8.1)
canola (8.9)
carrots
fababeans (9.0)
flax (8.9)
lentils (8.4)
mustard, tame (8.9)
onion, dry bulb (8.6)
peas (field, processing) (9.0)
potatoes (8.7)
rye [fall (9.0), spring (8.7)]
soybeans (8.8)
sugar beets
sunflowers (8.4)(except Corona)
triticale (8.8)
wheat, spring (8.5)
wheat (durum, winter) (9.0)

Forages, only in year of establishment
alfalfa (9.0)
bromegrass
clover (red, sweet)
fescue, creeping red (8.8)
ryegrass, Russian wild (7.6)
wheatgrass [crested (8.2), intermediate]

4. WEEDS CONTROLLED: Wild oats (7.7), foxtail (green, yellow)(7.6), barnyard grass (8.0), Persian darnel (7.0), volunteer corn.

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***WEEDS*** - Barnyard grass, foxtail, wild oats: 1-4 leaf. Persian darnel: 1-3 leaf. Volunteer corn: 15-25 cm. ***CROPS*** - Barley 1-4 leaf, prior to tillering. Forages only in year of establishment; cannot use for food or feed.

7. HOW TO APPLY:
With: Aircraft or Ground equipment. Do not use controlled droplet application equipment.
Rate: 1.0-1.13 L/ac. Higher rate to control wild oats only, with leaves on the main stem and leaves on tillers totalling 5. ***Special Crops:*** 1.4 L/ac. ***Wild oats:*** in the 4-5 leaf stage, apply at 1.1 L/ac. ***When tank mixing:*** 1.13 L/ac, except with Decis 1.0-1.13 L/ac.
Water Volume: Air - 14 L/ac minimum. Ground - 45 L/ac
Pressure: Air - 300 kPa, Ground - 275 kPa.
Nozzles: Only flat fan recommended, tilt 45° forward to ensure better coverage.

8. APPLICATION TIPS: • Do not use on Betzes and Klages barley. • When tank mixing with bromoxynil do not delay Hoe-Grass 284 application if grassy weed is in correct stage. Reduced control can be expected if Hoe-Grass 284 is applied to weeds growing under stress. Control may be further reduced if tank mixed. • Apply at least 4 days before any broadleaf herbicide, except bromoxynil products, to eliminate a reduced grass kill from Hoe-Grass 284. Not recommended to apply Hoe-Grass 284 after a broadleaf herbicide. • During prolonged drought, excessivly high daytime temperatures (28°C), or low humidity; better grassy weed control will be achieved with Hoe-Grass 284 alone than if tank mixed.

9. HOW IT WORKS: Contact as well as systemic action. Uptake primarily through leaves and translocated to growing point. Penetration and uptake via roots may occur if soil is sufficiently moist and the rate of application is relatively high.

10. EXPECTED RESULTS: Yellowing of susceptible plants is noticable within 2-4 days of application. New leaf growth exhibits light chlorosis which deepens and browning develops 10-14 days after application. Photosynthesis and growth are inhibited and uptake of water and nutrients ceases. Lack of adequate crown root development is evident on wild oats as well as in some sensitive barley varieties.

11. EFFECTS OF RAINFALL: Rainfall within 1 hour will decrease activity.

12. MOVEMENT IN SOIL: Some movement in soil if sufficient moisture is present.

13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Danger from drift is low. ***Grazing Restrictions:*** Do not graze treated green crop. Do not apply within 60 days of harvest. ***Succeeding Crops:*** No restriction.

14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (2,235). Toxic to fish; non-toxic to birds.

15. PRECAUTIONS, FIRST AID: Highly corrosive, protect eyes and skin. Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention immediately.

16. STORAGE: Do not store below freezing. If stored 1 year or longer, shake well before using.

HYVAR X (bromacil)

DuPont

1. FORMULATIONS: Wettable Powder; Hyvar X; 80%; 2 kg, 25 kg bags. Water Soluble Liquid; Hyvar X-L; 240 g/L; 4 L, 10 L jugs.
2. REGISTERED MIXES: None
3. CROPS: Non-crop areas only. Total vegetation control.
4. WEEDS CONTROLLED: A non-selective, total vegetation control chemical for weeds, grasses and some brush.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: See "Soil Sterilants" page 3.
7. HOW TO APPLY:
   A) Hyvar X-L
   With: Power sprayer. Handguns, backpack sprayers or a watering can may be used to treat small areas.
   Rate: ***Initial Treatment:*** Apply 12-18 L/ac. Higher dosage on soils containing 5% or more organic matter, or soils high in clay content. ***Retreatment of Regrowth:*** 7-9 L/ac. ***Small Areas:*** 450 mL/100 m². ***Brush Control:*** Spot Treatment - undiluted at 8 mL/m of tree height up to 3 m. Four or five 8 mL deposits around the root collar for brush taller than 3 m with a spot gun. Spot Treatment Diluted - mix 1 L in 5 L of water, apply in 55 mL deposits with a spot gun.
   B) Hyvar X
   Same as Hyvar X-L, except more efficient agitation of the spray solution is required.
   Rate: ***Initial Treatment:*** 3-5 kg/ac. Use the higher dosage on soils containing 5% or more organic matter, or soils high in clay content. ***Retreatment of regrowth:*** 1.5-2.7 kg/ac. ***Small areas:*** 135 g/100 m² ***Brush Control:*** Mix 870 g Hyvar X in 10 L of water and apply 30-60 mL/stem 5-10 cm in basal diameter. Wet base of stem to point of runoff.
   Water Volume: Hyvar X-L with a handgun apply 650 L of spray solution/ac. Hyvar X use a minimum of 20 L of water/kg of Hyvar X. See "Soil Sterilants" page 3.
8. APPLICATION TIPS: See "Soil Sterilants" page 3.
9. HOW IT WORKS: Hyvar X is readily absorbed through the roots but much less readily through the leaves. Once in the plant it inhibits photosynthesis. **Caution:** Do not apply closer than 1.5 times the height of desirable vegetation.
10. EXPECTED RESULTS: Susceptible plants become chlorotic and then die. Vegetation kill is faster with higher rainfall. ***Poor results may be expected if:*** weed growth too mature or if there is insufficient rainfall.
11. EFFECTS OF RAINFALL: Rainfall will carry the chemical into the root zone where it is absorbed.
12. MOVEMENT IN SOIL: Movement in soil is dependent upon soil type and soil moisture. Bromacil will move faster in a vertical direction in sandy soils than in soils high in organic matter or clay content. Movement can be severe on slopes.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** All crops and ornamentals may be injured by chemical drift. Do not apply in areas subject to severe soil erosion.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,200). Toxic to fish.
15. PRECAUTIONS, FIRST AID: Hyvar X-L is combustible. While applying undiluted product, do not smoke and keep away from heat and open flame. Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Hyvar X - Store in a cool dry place. Hyvar X-L - Combustible, keep away from heat or open flame. Do not allow to freeze.

KARMEX (diuron)

DuPont

1. FORMULATIONS: Wettable Powder; 80%; 2 kg, 25 kg packs.
2. REGISTERED MIXES: None
3. CROPS: Asparagus; irrigation and drainage ditches, ponds, dug-outs and spot treatment for general weed control. Non-crop areas.
4. WEEDS CONTROLLED: Broad leaved and grassy weed seedlings.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: May be used at any time, except when the ground is frozen. Best results obtained when applied shortly before weed growth begins. Dense weed growth should be removed first then treatment applied. Sufficient rainfall or irrigation is necessary following treatment to carry the chemical to the root zone. ***Asparagus (established)*** - no earlier than 4 weeks before spear emergence and no later than the early cutting period. ***Irrigation and Drainage Ditches*** - before expected seasonal rainfall, if possible when soil in the ditch is still moist. Apply during the non-crop season when the ditch is not in use.
7. HOW TO APPLY:
   With: Field sprayer, hand sprayer, back-pack or sprinkling can.
   Rate: ***General Weed Control:*** Sandy or sandy loam soils 5.8-11 kg/ac. Clays or high organic soils 16-22 kg/ac. Use the lower rate when annual weed growth predominates and where only one season's control is desired. ***Retreatment of Regrowth:*** Annuals and seedlings 500 g/ac. ***Irrigation and Drainage Ditches:*** 250-750 g/100 m^2 or 9.3-27 kg/ac. Flush once before using for irrigation purposes. Karmex must be fixed in the soil by moisture to minimize movement in irrigation water. ***Spot Treatment:*** Couch grass, toadflax 0.75-1.0 kg/100 m^2 ***Small Areas:*** 50 g/10 m^2 is equal to 20.2 kg/ac.
   Water Volume: Use 100-160 L of water/acre to provide thorough, uniform coverage.
8. APPLICATION TIPS: See "Soil Sterilants" page 3. Do not use on sand, loamy sand, or gravelly soils with less than 1% organic matter.
9. HOW IT WORKS: Diuron is readily absorbed through the root system and less readily absorbed through stem and foliage.
10. EXPECTED RESULTS: Susceptible plants become chlorotic soon after treatment and then die. Poor control may be expected from inadequate rate or weeds too old or insufficient rainfall. Application on slopes may cause erosion. Application too near feeding roots of susceptible vegetation may cause injury.
11. EFFECTS OF RAINFALL: Rainfall will activate the chemical, carrying it into the root zone.
12. MOVEMENT IN SOIL: Diuron absorbs readily to the soil and there is little movement by leaching.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** All crops and ornamentals may be injured by chemical drift. ***Succeeding Crops:*** Do not replant treated areas to any crop within 2 years after last treatment as injury to subsequent crops may result.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,400). Non-toxic to birds and fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Store in a cool dry place.

KERB 50W (propyzamide)

Rohm and Haas

1. FORMULATIONS: Wettable Powder; 50%; 2.0 kg bags
2. REGISTERED MIXES: None specified.
3. CROPS: Alfalfa (established, seedling) (8.7), bird's-foot trefoil, grass (established), pastures (grass/legume).
4. WEEDS CONTROLLED:

barley (foxtail (7.5), volunteer)	grass, orchard (8.3)	oats, wild (5.9)	timothy
chickweed (8.2)	most annual grasses	quackgrass, seedling (7.4)	wheat, volunteer

5. WEEDS SUPPRESSED: None.
6. WHEN USED: ***Fall:*** alfalfa, bird's-foot trefoil. Apply between October 1 and freeze-up. Best results are obtained when soil temperature is low but above freezing and soil moisture is high. ***Spring:*** alfalfa (grown for seed). For optimum control, the soil temperature should be cool.
7. HOW TO APPLY:
   With: Ground equipment only.
   Rate: ***Fall:*** Alfalfa, bird's-foot trefoil (established, seedling) - annual grasses, volunteer grain, wild oats = 710 g/ac; quackgrass, orchard grass, timothy, chickweed = 910-1310 g/ac. • Pasture (established) - brown, dark brown, grey wooded soils = 275-365 g/ac; thin black or black soils = 365-455 g/ac. ***Spring:*** Alfalfa (grown for seed) - annual grasses, volunteer grain, wild oats = 710 g/ac maximum; quackgrass, orchard grass, timothy, chickweed = 910 g/ac maximum.
   Water Volume: 40-200 L/ac
   Incorporation: None. Spring application on alfalfa, if soil temperature is high and moisture content low, a light incorporation is recommended.
   Pressure: 275 kPa.
   Nozzles: Flat fan. 50 mesh or larger metal filters and nozzle screens.
8. APPLICATION TIPS: • Do not use on highly organic peat or muck soils. • Avoid application to timothy, fescue, or perennial blue grass. • In fall, rain in 1 or 2 days, or a light overhead irrigation (1.25-2.5 cm) improves results.
9. HOW IT WORKS: Root absorption. Inhibits cell division.
10. EXPECTED RESULTS: Plant growth stops, turns brown and dies.
11. EFFECT OF RAINFALL: Improves efficacy.
12. MOVEMENT IN SOIL: Very little leaching. Readily absorbed on organic matter.
13. GRAZING AND CROPPING RESTRICTIONS: Do not harvest or graze within 90 days of applying 1.3 kg/ac or 60 days after lower rates. Wait 9 months before planting other crops.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) rats = (8,350).
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in cool dry place.

KIL-MOR (2,4-D + mecoprop + dicamba)

Ciba-Geigy

1. FORMULATIONS: Liquid; 295 g/L 2,4-D + 80 g/L mecoprop + 110 g/L dicamba; 10 L jugs.
2. REGISTERED MIXES: Kil-Mor 345-445 mL/ac + Aatrex Liquid 2.25 L/ha or Aatrex Nine-0 1.25 kg/ha.
3. CROPS: Barley (8.5), corn (7.3)(field, sweet), oats (8.6), roadsides, stubble fields, summerfallow, wheat (durum, spring, [winter)(7.9). ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED:

In crops

artichoke, Jerusalem (in corn)
bindweed, hedge
buckwheats (Tartary, volunteer, wild)(7.9)
cockle, cow (7.6)
cocklebur
flixweed (7.8)
knotweed
lady's-thumb
lamb's-quarters (8.5)
mustards (ball, volunteer, wild, wormseed)(8.6)
pigweed (prostrate, redroot)(7.9)
ragweed, common
shepherd's-purse(8.6)
smartweeds, annual (7.7)
spurry, corn (7.3)
sow-thistle, annual
stinkweed (8.8)
thistle, Russian (7.3)

Along roadsides

alders
chicory
cockle, white
goat's-beard
poison-ivy
ragwort
sheep-laurel
thistle, bull

5. WEEDS SUPPRESSED: Field bindweed, Canada thistle, cleavers, round-leaved mallow.
6. WHEN USED: ***Barley:*** 2-3 leaf stage. ***Corn:*** Overall spray prior to 15 cm height of corn, use drop nozzles after 15 cm height. ***Oats:*** 3-4 leaf stage. ***Roadsides:*** Spring when weeds are in 2-5 leaf stage and growing actively. ***Wheat (spring):*** 3-5 leaf stage. ***Wheat (winter):*** in spring before crop is 30 cm high.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: Barley - 340 mL/ac. Corn (sweet), oats, wheat (spring, winter) - 340-445 mL/ac. Roadsides - 1.3 L/ac. Stubble, Summerfallow - 445-710 mL/ac
   Water Volume: 40 L/ac for cereals; 80-140 L/ac for corn.
   Pressure: 275 kPa
8. APPLICATION TIPS: • Barley is the most sensitive crop to Kil-Mor. Ensure that proper rate, water volume and timing are used, otherwise, crop injury may occur. Risk of crop injury increases as water volume drops below 36 L/ac. • Do not apply when temperatures exceed 27°C and relative humidity is very high.
9. HOW IT WORKS: accummulates in the growing points resulting in abnormal growth which disrupts the transport system in plants.
10. EXPECTED RESULTS: ***Weeds:*** Visible effects occur 7-14 days after spraying. Leaves curl, leaf petioles twist, leaf edges turn brown, the whole plant ceases growth, eventually turns brown, and dies. ***Crop:*** Improper applications can result in abnormal bending at the internodes of grain stalks, difficulty in head emergence from sheath, curled awns, malformed kernels and sterile florets. ***Poor results may be expected if:*** Inadequate coverage. Rainfall less than 4 hours after application. Weeds overmature.
11. EFFECTS OF RAINFALL: Do not spray if rain is expected within 4 hours.
12. MOVEMENT IN SOIL: Not applicable
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Tomatoes, sugar beets, sunflowers, beans, turnips, cauliflower, cabbage, ornamentals and fruit crops are very sensitive to drift. ***Grazing Restrictions:*** None. ***Crop Use After Hail:*** No restrictions. ***Succeeding Crops:*** No restrictions.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,028). **Mecoprop has potential to produce enlarged kidneys after long-term continuous exposure.** The 2,4-D contains no dioxin. Non-toxic to fish. Toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Heated storage only.

KRENITE (fosamine)

DuPont

1. FORMULATIONS: Water Soluble Liquid; 480 g/L; 10 L pack.
2. REGISTERED MIXES: Non-ionic surfactants - DuPont Surfactant WK, Tween 20, Triton XA Special.
3. CROPS: Brush control on non-crop areas only.
4. WEEDS CONTROLLED:

alder	cherry*	hemlock*	poplar
ash	elm	maple	(trembling aspen, largetooth aspen*)
beech	fir, balsam*	oak	spruce, white*
birch	hazel	pine	

* = highest rate

5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: From mid-June to end of July.
7. HOW TO APPLY:
   With: Ground equipment,(high volume .
   Rate: 10.0-15.0 L/1,000 L of water. Add 1-2 L of surfactant to the mixture. Use higher rate for balsam fir, cherry, hemlock, largetooth aspen, white spruce.
   Water Volume: 200-1,200 L of spray solution/ac to point of runoff.
8. APPLICATION TIPS: Do not apply to food crops. A non-ionic surfactant is required to control most conifers and to control the root suckering of deciduous brush.
9. HOW IT WORKS: Absorbed by leaves, stems and buds. Restricts bud development the following spring.
10. EXPECTED RESULTS: Injury may not be observed until the following spring, particularly if minimum rates are used or if cool temperatures prevail when spraying is done. Plants will fail to develop leaves and subsequently die.
11. EFFECTS OF RAINFALL: Rainfall within 24 hours of application may reduce effectiveness.
12. MOVEMENT IN SOIL: Little downward movement as Krenite readily adsorbs to soil colloids.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze on land treated with Krenite.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (20,000). Non-toxic to birds and fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in a cool dry place.

KROVAR I (bromacil + diuron)

DuPont

1. FORMULATIONS: Wettable Powder; 40 + 40%; 2 kg, 25 kg bag.
2. REGISTERED MIXES: None. ***Mixing Instructions:*** Do not use air agitation.
3. CROPS: Non-crop areas only. Total vegetation control.
4. WEEDS CONTROLLED: Most annual and perennial weeds and grasses.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: Before weeds emerge or when actively growing. Remove dense growth before treatment. Do not apply when ground is frozen. Sufficient moisture is required to carry the chemical to the root zone of the weeds.
7. HOW TO APPLY:
   With: Boom sprayer, hand gun, back pack, or sprinkling can.
   Rate: ***General Weed Control:*** 5.3-7.3 kg/ac Use higher rates on soils containing 5% or more organic matter or soils high in clay content. Use 5.5 kg/ac on sandy or sandy loam soils only. ***Retreatment of Regrowth:*** 2.75-3.6 kg/ac when annual weeds reappear on previously treated sites. ***Small Areas:*** 180 g/100 m^2, approximately 7.3 kg/ac.
   Water Volume: 20 L water (minimum)/kg of Krovar I.
8. APPLICATION TIPS: See "Soil Sterilants" page 3.
9. HOW IT WORKS: Readily absorbed through the roots, leaves and stems.
10. EXPECTED RESULTS: Plants become chlorotic and then die. The degree of control and duration of effect will vary with the amount of chemical applied, soil type, rainfall, and other factors. ***Poor results occur if:*** weeds are too mature or insufficient rainfall.
11. EFFECTS OF RAINFALL: Rainfall will leach the chemical into the root zone.
12. MOVEMENT IN SOIL: Soil movement is faster with heavier rainfall. Do not use in areas subject to soil erosion.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** All crops and ornamentals may be injured by chemical drift. ***Succeeding Crops:*** Krovar I is a non-selective residual herbicide. It should only be used on non-crop areas where bare ground is desired.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = bromacil (5,200), diuron (3,400). Non-toxic to birds; toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Store in a cool, dry place.

LADDOK (bentazon + atrazine)
BASF

1. FORMULATIONS: Liquid Suspension; 200 g/L + 200 g/L; 10 L pack.
2. REGISTERED MIXES: None. Surfactant: Assist Oil Concentrate.
3. CROPS: Corn (field, seed, silage, sweet)
4. WEEDS CONTROLLED:

buttercup	groundsel, common	nightshade, black	rape, bird
chickweed, common	lady's-thumb	pigweed, redroot	smartweeds, annual
cocklebur	lamb's-quarters	purslane	spurry, corn
galinsoga, hairy	mustard, wild	ragweed (common, giant)	thistle, Russian

5. WEEDS SUPPRESSED: None.
6. WHEN USED: Apply 18-28 days after seeding. Corn tolerant at all growth stages.
7. HOW TO APPLY:
   With: Ground.
   Rate: 0.8-1.6 L/ac. Assist Oil Concentrate - 10 L/1000 L of spray volume is recommended.
   Water Volume: 80-160 L/ac
   Pressure: 275-400 kPa
   Nozzles: Flat fan or cone type only recommended.
8. APPLICATION TIPS: • Best results if weeds are young and actively growing. • Do not apply where run-off erosion is likely to occur. • Do not apply if crop is under stress from prolonged cold weather, poor fertility or when crop is wet and succulent from recent rainfall as crop injury may occur.
9. HOW IT WORKS: Both bentazon and atrazine are contact herbicides interfering with photosynthesis.
10. EXPECTED RESULTS: ***Weeds:*** turn yellow, then brown, usually within 2 weeks. ***Crops:*** occassionally show light leaf speckling. ***Poor results may occur if:*** weeds are too mature, failure to penetrate crop canopy or under conditions of prolonged cool weather or drought.
11. EFFECTS OF RAINFALL: Within 6-8 hours may reduce activity.
12. MOVEMENT IN SOIL: Very little, except in sandy soil and with excessive moisture.
13. GRAZING AND CROPPING RESTRICTIONS: ***Grazing Restrictions:*** Treated plants can be used for silage. ***Succeeding Crops:*** On very light soils with low organic matter some atrazine may carry over and injure susceptible crops.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,000).
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Store in a cool dry place above 0°C.

LEXONE (metribuzin)

DuPont

1. FORMULATIONS: Dry Flowable; Lexone DF; 75%; 2.5 kg bag. Liquid Suspension; Lexone L; 480 g/L; 10 L jug.

2. REGISTERED MIXES: Banvel, Eptam 8-E, MCPA amine 500, Treflan 545 Ec. ***Mix Instructions:*** Shake Lexone L containers well before adding to tank.

3. CROPS: Barley(8.9)(except Klondike), fababeans (Lexone+Treflan), potatoes (8.6) (except red skinned, or early maturing varieties, Belleisle, ND 146-4R, Rideau, Shepody, Tobique), tomatoes, wheat (8.5)(spring).

4. WEEDS CONTROLLED:

buckwheat, Tartary	lady'-thumb	pigweed, redroot	smartweeds, green (8.5)
chickweed (8.1)	lamb's-quarters (8.4)	rapeseed, volunteer (8.8)	spurry, corn (7.1)
hemp-nettle (8.4)	mustard (ball, wild)(8.0)	shepherd's-purse	stinkweed (8.2)

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***Barley, wheat:*** Lexone, 2-5 leaf; Banvel Mix, 2-3 leaf; MCPA Mix, 3-5 leaf. ***Fababeans:*** Treflan Mix, pre-plant incorporated in spring or fall. ***Potatoes:*** Crop injury may result if used on sandy or coarse textured soils with less than 1% organic matter. Resistence to Lexone varies among varieties. Test for safety on a limited area before large scale sprays are adopted. Do not use on red skinned or early maturing varieties, Belleisle, ND 146-4R, Rideau, Shepody, or Tobique. ***Potatoes (dryland):*** Lexone, early post-emergent - apply over the top of potato plants soon after emergence and before weeds are 4 cm tall. Eptam Mix, pre-plant incorporated - apply as by Eptam label. Crop injury may occur if used on soil with greater than 7% organic matter or, on sandy or coarse textured soils with less than 2% organic matter. ***Potatoes (irrigated):*** Lexone, pre-emergent - a single application after planting (at least 5 cm deep) or hilling but before crop emerges and before weeds are 3 cm tall. Lexone, early post-emergent - applied following 3 or more successive days of sunny weather. Treat before weeds are 3 cm tall and potatoes are less than 10 cm tall. Lexone, pre+post-emergent - same as early post-emergent but do not apply more than 910 mL/ac or 567 g/ac per season. ***Tomato transplants, grown for processing only:*** as directed spray before weeds are 4 cm tall. Avoid spray contact with at least 2/3 of the tomato foliage. Best results when plants are well established about 3 weeks after transplanting. Do not apply to direct-seeded tomatoes.

7. HOW TO APPLY:
With: Ground equipment. 50 mesh line strainer and screens.
Rate:

Crop	Lexone DF (g/ac)	Lexone L (mL/ac)	Tank Mix
Barley	110-142	170-220	-
Barley, wheat (spring).	110	170	Banvel 400 (480) 110 (93) mL/ac
Barley, wheat (spring).	110-142	170-220	MCPA Amine 345-445 mL/ac
Wheat (spring)	110	170	-
Fababeans (fall)	160-220	250-345	Treflan 545 EC 810-1050 mL/ac
Fababeans (spring)	140-220	220-345	Treflan 545 EC 610-810 mL/ac
Potatoes (dryland) early post-emergent	140	220	-
Potatoes (dryland) pre-plant	140-220	220-345	Eptam 8-E 1.7-2.2 L/ac
Potatoes (irrigated) early post-emergent	285-390	445-610	-
Potatoes (irrigated) pre-emergent	260-567	400-910	-
Potatoes (irrigated) pre + post-emergent	567 maximum	910 maximum	-
Tomato transplants (light soils)	130	200	-
(medium soils)	260	400	-
(heavy soils)	260-445	400-710	

Water Volume: Barley, fababeans, wheat (spring) - 32-40 L/ac. Potatoes - dryland 81-121 L/ac; irrigated 61-121 L/ac. Tomato transplants, grown for processing only - 81 L/ac.

8. APPLICATION TIPS: • Allow 4-5 day interval before or after application of wild oat herbicides. • If frost occurs, allow 4-5 day interval for crop to recover before applying Lexone. • Crop must be planted at least 5 cm deep.

9. HOW IT WORKS: A systemic herbicide absorbed by foliage and roots. Affected plants become chlorotic and stunted. Death usually occurs 10-14 days after treatment. Because Lexone leaves a residue in the soil, control of shallow germinating weeds (eg. chickweed) occurs throughout the growing season.

10. EXPECTED RESULTS: ***Weeds:*** Should start to yellow within 7-10 days after treatment. ***Crop:*** Temporary (7-10 days) lightening in colour and occasionally a slight reduction in height may occur, especially if frost or abnormally high temperatures occur within 1-2 days of application. Injury to barley can occur if there is shading for 12 hours after spraying. Thus avoid late evening or cloudy day applications. ***Poor results may be expected if:*** it rains immediately after application or weeds are under stress or too mature.

11. EFFECTS OF RAINFALL: Do not spray if rain is expected within 2 hours. Heavy rainfall immediately after application may decrease activity.

12. MOVEMENT IN SOIL: Not applicable

13. GRAZING AND CROPPING RESTRICTIONS: Do not apply within 60 days of harvest. ***Grazing Restrictions:*** Do not graze or feed to livestock within 30 days of application. ***Succeeding Crops:*** Canola, celery, cole crops, cucurbits, lettuce, onions, peppers, spinach, sugar beets, sunflowers, table beets, and turnips may be injured if planted in Lexone treated soil both during year of application and the following crop year. Fall seeded or cover crops such as oats and rye may be injured if seeded during the same season as Lexone treatment.

14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,100). Slightly toxic to fish and birds. Non-toxic to bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.

16. STORAGE: Lexone DF - Cool dry place. Lexone L - warm storage preferred. If frozen ensure material has been thoroughly resuspended.
    NOTE: A similar product, Sencor (page 86), has additional registration on the following : ***Crops*** - Alfalfa, Klondike barley, triazine tolerant canola, lentils, and field peas. ***Weeds Controlled*** - night-flowering catchfly, common groundsel, henbit, wormseed mustard.

LONTREL (clopyralid)

Dow

1. FORMULATIONS: Solution; 200 g/L; 4 L jug.
2. REGISTERED MIXES: Hoe-Grass 284, Poast.
3. CROPS: Polish and Argent ine varieties of rapeseed (including canola)(8.6). ***Underseeding:*** not recommended for forage legumes.
4. WEEDS CONTROLLED:
   buckwheat, wild (6.1) chamomile, scentless thistle, Canada (8.3)
5. WEEDS SUPPRESSED: perennial sow-thistle (7.0)(top control only).
6. WHEN USED: Rapeseed (canola) 3-6 leaf. Canada thistle 10 cm tall to early bud stage and actively growing.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 405-605 mL/ac
   Water Volume: 40-80 L/ac
   Pressure: 200-275 kPa
   Nozzles: Use nozzles that deliver higher volumes and coarser droplets.
8. APPLICATION TIPS: • Make sure the sprayer tank has been thoroughly cleaned before Lontrel is mixed in the tank. Trace contamination from 2,4-D; MCPA; or similar herbicides will result in damage to rapeseed. • Treat during warm weather when weeds are actively growing.
9. HOW IT WORKS: Absorbed by leaf and stem surfaces and readily translocated. Maximum efficacy results from foliar application to young actively growing plants.
10. EXPECTED RESULTS: Growth will first slow then cease. Death of weed may not occur until 14-21 days after treatment.
11. EFFECTS OF RAINFALL: A rain free period of 4-6 hours is required.
12. MOVEMENT IN SOIL: Small amounts may carry over in soil into the year after treatment, but is generally not mobile in soil under typical prairie conditions.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Small amounts of drift may damage broad-leaved plants. ***Succeeding Crops:*** Fields previously treated with Lontrel can be seeded to barley, flax, oats, rapeseed, rye, wheat or should be summerfallowed the year after treatment. ***Grazing Restrictions:*** None. ***Succeeding Crops:*** Do not seed to crops other than those listed above, the year after treatment.
14. TOXICITY: Very low acute mammalian toxicity. Oral LD_{50} rats = greater than 5,000 mg/kg. Oral LD_{50} bees = greater than 100 ug/bee. Extremely low toxicity to fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store away from food, feedstuffs, fertilizer, seeds, insecticides, fungicides, or other pesticides. Store in heated storage. If frozen, warm to room temperature and agitate.

LOROX L (linuron)
DuPont

1. FORMULATIONS: Liquid Suspension; 480 g/L; 10 L jug.

2. REGISTERED MIXES: Atrazine 80W (corn, field); Estemine MCPA, MCPA amine 500 [barley, oats, wheat (spring)]; MCPA K-Salt [barley, wheat (spring)]; Target [barley, oats, wheat (durum, spring)]; Sweep+MCPA amine 500 (chemical fallow). ***Mix Instructions:*** Shake Lorox containers thoroughly before adding to tank. If a surfactant is recommended, dilute with 10 parts of water and add as last ingredient to nearly full tank.

3. CROPS:

Lorox L

asparagus (8.7)
carrots (8.2)
corn, field (6.5)
fruit trees
(apple, pear, plum, cherry)
potatoes (8.7)

Shelterbelts

ash (green)
caragana
elm (American, Siberian)
maple (Manitoba)
pine (Scotch)
poplar
spruce (Colorado, white)
willow

Lorox L+MCPA Amine 500

barley (8.6)
oats (8.9)
wheat (spring, durum)(8.2)

4. WEEDS CONTROLLED:

Lorox L

buckwheat, wild (8.5)
chickweed, common (9.0)
goosefoot (8.4)
grass, barnyard (8.3)
knotweed
lamb's-quarters (7.9)
mustard, wormseed (8.9)
pigweed, redroot (8.3)
purslane (8.4)
ragweed
shepherd's-purse
smartweeds (9.0)
stinkweed (8.5)
sow-thistle, annual

Underseeding: forages not recommended.

Lorox L+MCPA Amine 500

buckwheat
[Tartary (7.3), wild]
chickweed, common
cockle, cow
flixweed
hemp-nettle (7.5)
lamb's-quarters
pigweed, redroot
ragweed
shepherd's-purse
smartweeds (7.0)
spurry, corn
stinkweed
stork's bill (8.3)

5. WEEDS SUPPRESSED: ***Lorox L*** - foxtail (green, yellow). ***Lorox L+MCPA Amine 500*** - foxtail (green, yellow); thistle (Canada) (4.4)

6. WHEN USED: alone - Lorox L. **WEEDS:** 1-4 leaf. ***Green foxtail:*** 1-3 leaf. **CROPS:** ***Asparagus:*** immediately after discing, before crop emergence; may be repeated after last cutting. ***Carrots:*** Pre-emergent; after planting (at least 1 cm deep) but before crop emergence. Post-emergent; 2 or more fully developed true leaves (8-15 cm tall). Before annual grasses 5 cm tall, broad-leaved weeds 15 cm tall. Pre+Post-emergent; observe limitations of Pre and Post-emergent treatments. To prevent crop injury treatments must be at least 2 weeks apart. ***Cereals:*** 2-4 leaf. ***Chemical Fallow:*** Sweep+MCPA Mix; when broad-leaved weeds small and actively growing, annual grasses 2-4 leaf. Only 1/season, only in spring. ***Corn:*** Alone; post-emergent, after corn is at least 38 cm tall, directed spray. Atrazine 80W Mix; pre-emergent, after planting at least 5 cm deep but before crop emergence. Do not spray over top of corn. ***Fruit trees (established at least 10 years, peach 1 year):*** directed spray under trees and bushes before buds open and before weeds 10 cm tall. ***Potatoes:*** Pre-emergent; after planting (at least 5 cm deep) but before crop emergence. Before grassy weeds 5 cm tall, broad-leaved weeds 15 cm tall. Treat after final hilling operation. **Shelterbelts:** stock planted for at least 1 year; directed spray under trees and bushes before buds open in spring, before weeds 10 cm tall.

7. HOW TO APPLY:

With: Aircraft or Ground equipment.

Rate:

Crop	Time (crop)	Lorox L (L/ac)	Tank Mix
Asparagus	pre-emergent	1.4-1.8	-
Barley, oats, wheat (spring).	2-4 leaf	0.17-0.22	MCPA Amine 500; 345-445 mL/ac
Barley, wheat (spring).	2-4 leaf	1.7-2.2	MCPA K-Salt 405-567 mL/ac
Carrots	pre-emergent	0.45-1.37	-
Carrots	post-emergent	0.91-1.82	-
Carrots	pre+post-emergent	0.45-0.91; 0.91-1.82	-
Chemical Fallow	spring only	0.21	Sweep 910 mL/ac+MCPA Amine 500; 445 mL/ac
Corn (2% or less soil O.M.)	pre-emergent	0.91	Atrazine 80W 610 g/ac
Corn (2-5% soil O.M.)	pre-emergent	1.3	Atrazine 80W 910 g/ac
Corn	post-emergent	0.97-1.82	Oil-water emulsion
Fruit trees	spring	3.6	Surfactant
Potatoes	pre-emergent	0.91-1.82	-
Shelterbelts	spring	1.82	-

Water Volume: Asparagus, potatoes: 120 L/ac. Carrots: 90-135 L/ac. Cereals: 40 L/ac minimum. Corn: pre-emergent 90-135 L/ac; post-emergent 70-140 L/ac. Fruit trees: 160-240 L/ac.
Incorporation: Not applicable
Pressure: 275 kPa
Nozzles: Flat fan recommended. 50 mesh line strainers and screens.

8. APPLICATION TIPS: • ***Do not use on sandy or coarse-textured soils, low in organic matter, as crop injury may result.*** • Do not use when crops are under drought stress. • Fruit trees - avoid contact with fruit, foliage, and green bark with spray or drift as injury may result.
9. HOW IT WORKS: A systemic herbicide absorbed by leaves and roots. Yellowing (chlorosis), stunting and finally death occurs 10-14 days after treatment.
10. EXPECTED RESULTS: ***Weeds:*** Yellowing starts 7-10 days after application. Effect greatest under excellent growing conditions. Weed control will vary depending on species, time of application and growing conditions. ***Crop:*** A slight yellowing of crop and leaf tip and leaf margin burn may be seen 7-10 days after application. Crop recovers within 14-18 days. Crop injury can occur if applied during period of high heat.
11. EFFECTS OF RAINFALL: Heavy rainfall within 2 hours may decrease activity. Pre-emergent treatment requires rainfall or irrigation for activation. Carrots, corn, or potatoes may be severely injured if unusually heavy rains follow application.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: Do not apply post-emergent corn treatment within 60 days of harvest. 25% carryover into next growing season if rates are 1.8 L/ac or higher. Do not feed or graze green material. ***Succeeding Crops:*** Do not follow corn, treated with Lorox L+Atrazine 80W, with sugar beets or vegetables.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,500). Very toxic to fish. Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Lorox L - Store in a heated area. Do not freeze as settling may occur. If frozen, thoroughly mix to resuspend. **NOTE:** A similar product, Afolan F (page 13), has additional registration on the following: ***Crops*** - celery, dill, parsnips. ***Weeds Controlled*** - fall panicum, wild radish, prickly lettuce, perennial sow-thistle (seedling).

MATAVEN (flamprop-methyl)

Ciba-Geigy

1. FORMULATIONS: Emulsifiable Concentrate; 84 g/L; 2 X 10 L pack.
2. REGISTERED MIXES: Mataven + Glean (Wheat only) ***Mixing Instructions:*** Mataven Only: add 1/2 the required amount of water, add Mataven, agitate, then add rest of water. Mataven+Glean: add 1/2 the required amount of water, start agitation, add Glean and ensure that it is completely in suspension, add more water, then Mataven, then the remainder of water.
3. CROPS:

canary grass (8.7)	***Seed production only, establishment year only***	fescue [creeping red (9.0), meadow (8.5)]	trefoil, bird's-foot
triticale	alfalfa (8.3)	milk vetch, cicer	wheatgrass [crested (8.3), intermediate (9.0)]
wheat (durum, spring, winter) (except Garnet, Selkirk)(8.9)	brome grass (8.6)	ryegrass, Russian wild (8.7)	
sunflower	clover, red	sainfoin	

4. WEEDS CONTROLLED: Wild oats (8.0)
5. WEEDS SUPPRESSED: None
6. WHEN USED: 3 leaf to shot blade stage of wild oats; wild oats at 2 leaf stage and younger may escape control and may grow to maturity. Do not apply beyond 6 leaf stage of the crop. Apply tank mix when wild oats in 3-4 leaf stage.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment. Do not apply Mataven + Glean tank mix by air.
   Rate: 2 L/ac. Forage Grasses: 2.0-3.0 L/ac. High rate without a companion crop; low rate with wheat as a companion crop. Sunflowers: 2.0-2.8 L/ac. 2.0 L/ac Mataven + 6-12 g/ac Glean (wheat only).
   Water Volume: Aircraft - 8 L/ac minimum; Ground - 40 L/ac.
   Pressure: Ground 300 kPa.
8. APPLICATION TIPS: • Best results will be obtained when the majority of wild oats are at the 3-4 leaf stage, but before the flag leaf stage. • Allow 4-day interval between the application of Mataven and the use of MCPA, bromoxynil, or bromoxynil + MCPA; and an interval of 7 days with the use of 2,4-D or dicamba formulations. • The 40 L/ac spray volume will provide better control of wild oats, especially where there is a heavy crop canopy or dense growth of wild oats. • Direct spray pattern 45° forward to enhance spray penetration. • Agitation required to re-emulsify spray if allowed to stand for several hours.
9. HOW IT WORKS: A systemic, absorbed through leaves and translocated to the growing point. Cell elongation is inhibited and cell initiation and division is impaired. Wild oats are unable to compete with the crop because of stunting or death.
10. EXPECTED RESULTS: Initially a dark blue-green colour appears 10 days after spraying then the wild oats turn yellow and brown. Wild oats in the 1-2 leaf stage at application may often appear controlled but may escape and grow to maturity. Will be small, stunted plants with few shrivelled seeds.
11. EFFECTS OF RAINFALL: Rainfall within 2 hours of application will reduce effectiveness.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Drift potential is low. Oats would be the most seriously affected crop. ***Grazing Restrictions:*** Do not graze treated areas. ***Crop Use After Hail:*** Do not graze or feed to livestock. ***Succeeding Crops:*** No restrictions.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (1210). Eye irritant Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) plus goggles when handling this product. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: Heated storage is recommended.

MCPA (amine, ester, K and Na salts)

Numerous Manufacturers

1. FORMULATIONS: ***Liquid*** - MCPA Amine (500, 80), Estemine MCPA; 500 g/L; MCPA Potassium (K) salt - MCPA K; 400 g/L. ***Emulsifiable Concentrate*** - MCPA Ester (500, 80); 500 g/L. ***Solution*** - Sodium (Na) salt - MCPA Sodium (Na) 300 g/L. 2 X 10 L, 20 L containers.

2. REGISTERED MIXES: **(amount of MCPA in brackets if different from MCPA alone) READ THE LABELS.**
MCPA Amine: Afolan F, Banvel, Basfapon, Buctril M (223 mL/ac), Cobutox 400 (28 mL/ac), Dowpon, Embutox (28 mL/ac), Hoe-Grass II (28 mL/ac), Lexone, Lorox L, Pardner, Poast, Sencor, Sweep, TCA, Torch DS.
MCPA Ester: Avenge, Avenge + Pardner, Avenge + Torch DS, Basfapon, Bromox 720 (223 mL/ac), Buctril M (223 mL/ac), Hoe-Grass II (28 mL/ac), Pardner, Poast, Sabre (223 mL/ac), Stampede 360, Sweep, Torch DS.
MCPA Potassium (K) Salt: Banvel, Basfapon, Buctril M (278 mL/ac), Cobutox 400 (35 mL/ac), Embutox (35 mL/ac), Lorox L, Pardner, Sweep, Torch DS.
MCPA Sodium (Na) Salt: Basfapon, Buctril M (371 mL/ac), Cobutox 400 (47 mL/ac), Embutox (47 mL/ac), Pardner, Pardner + TCA, Sweep, TCA. **NOTE:** Some formulations can be mixed with liquid fertilizers (28-0-0).
Mixing Restrictions: Insure that the proper formulation of MCPA, **rate**, and order of mixing is used when tank mixing.

3. CROPS:

MCPA Amine
Alfalfa* (estab.), asparagus, barley (8.7), corn, flax (8.5), grasses (estab.), non-crop areas, oats (9.0), pasture (grass, estab.), peas (field, processing), rangeland, rye (fall, spring), turf (estab.), wheat (durum, hard red spring (8.7), winter).
Underseeding: alfalfa*, clover (alsike, ladino, red).

MCPA Ester
Alfalfa* (estab.), asparagus, barley (8.0), flax, grasses (estab.), non-crop areas, oats (9.0), pasture (grass, estab.), rangeland, rye (fall, spring), wheat (durum, hard red spring (8.7), winter).
Underseeding: Do NOT use on crops underseeded to legumes.

MCPA K-Salt
Alfalfa* (estab.), barley, corn, flax, legumes* (estab.), rye (fall, spring), wheat (durum, hard red spring, winter).
Underseeding: alfalfa*, clover (alsike, ladino, red, white Dutch), bird's-foot trefoil

MCPA Na-Salt
Alfalfa* (estab.), barley, clover (estab.; red, alsike), corn, flax, non-crop areas, oats, pasture (grass, estab.), peas (field, processing), rye (fall, spring), turf (estab.), wheat (durum, hard red spring, winter).
Underseeding: legumes*

estab.=established ***Do NOT use on Flemish types of alfalfa or sweet clover.**

4. WEEDS CONTROLLED:

MCPA Amine
Group I burdock, clover (sweet), cocklebur, flixweed, kochia, lamb's-quarters, lettuce (prickly), mustards (ball, hare's-ear, Indian, tumble, wild, wormseed), pigweed (Russian), radish (wild), ragweeds (common, false, giant), shepherd's-purse, spurge (thyme-leaved), stinkweed, sunflower (wild), vetch. ***Group II*** bluebur, dragonhead (American), galinsoga (hairy), goosefoot (oak-leaved), mustards (dog, tansy), peppergrass (common, field), pigweed (redroot, tumble), pineappleweed, purslane.

MCPA Ester
Group I burdock, clover (sweet), cocklebur, flixweed, kochia, lamb's-quarters (8.5), lettuce (prickly), mustards (ball, hare's-ear, Indian, tumble, wild, wormseed), pigweed (Russian), radish (wild), ragweeds (common, false, giant), shepherd's-purse, stinkweed (8.3), sunflower (wild), vetch. ***Group II*** bluebur, galinsoga (hairy), goosefoot (oak-leaved), mustards (dog, tansy), peppergrass (common, field), pigweed (redroot), purslane.

MCPA K-Salt
Group I bluebur, burdock, cocklebur, flixweed, kochia, lamb's-quarters (8.5), lettuce (prickly), mustards (ball, hare's-ear, Indian, tumble, wild, wormseed), pigweed (Russian), radish (wild), ragweeds (common, false, giant), shepherd's-purse, stinkweed (8.3), sunflower (wild) ***Group II*** dandelion, dock (curled), goat's-beard, mustards (dog, tansy), peppergrass (field), pigweed (prostrate, redroot), purslane, smartweeds (annual), sow-thistle (annual), spurry (corn), wormwood (biennal). ***Group III*** spurge (leafy).

MCPA Na-Salt
Group I burdock, cocklebur, flixweed, horsetail (field), lamb's-quarters (8.5), lettuce (prickly), mustards (ball, hare's-ear, Indian, tumble, wild, wormseed), pigweed (Russian), radish (wild), ragweeds (common, false, giant), shepherd's-purse, stinkweed (8.3), sunflower (wild) ***Group II*** bluebur, buttercup (tall), dock (curled), galinsoga (hairy), goat's-beard, goosefoot (spear-leaved), mustards (dog, tansy), peppergrass, pigweed (redroot), purslane, smartweeds (annual).

5. WEEDS SUPPRESSED: (includes top growth control)

MCPA Amine	MCPA Ester	MCPA K-Salt	MCPA Na-Salt
Group I horsetail (field), plantain (common). ***Group II*** bindweeds (field, hedge), buckwheats [Tartary (4.3), wild (4.7)], dandelion, dock (curled), goat's-beard, gumweed, hemp-nettle (5.8), hoary cress, lettuce (blue), smartweeds (annual)(4.9), sow-thistles (annual, perennial), spurge (leafy), thistle (Canada), wormwood (biennial).	***Group I*** horsetail (field), plantain (common). ***Group II*** bindweeds (field, hedge), buckwheats [Tartary (4.3), wild (4.7)], dandelion, dock (curled), goat's-beard, gumweed, hemp-nettle (5.8), hoary cress, lettuce (blue), pigweed (redroot), smartweeds (annual), sow-thistles (annual, perennial), spurge (leafy), thistle (Canada), wormwood (biennial).	***Group I*** horsetail (field), vetch. ***Group II*** bindweeds (field, hedge), buckwheats (Tartary, wild), goosefoot, gumweed, hemp-nettle, hoary cress, lettuce (blue), sow-thistle (perennial), thistle (Canada).	***Group II*** bindweeds (field, hedge), buckwheats (Tartary, wild), goosefoot, gumweed, hemp-nettle, hoary cress, knapweed (Russian), lettuce (blue), sow-thistles (annual, perennial), spurge (leafy), thistle (Canada), wormwood (biennial).

6. WHEN USED:

Crop	MCPA Amine	MCPA Ester	MCPA K-Salt	MCPA Na-Salt
Alfalfa* (estab.)	Before crop growth starts in spring	Before crop growth starts in spring	Before crop is 2.5-5 cm tall	Before crop is 2.5-5 cm tall
Asparagus	After cultivation just before spears appear. May repeat at end of cutting season.	After cultivation just before spears appear. May repeat at end of cutting season.	--	--
Barley, rye, wheat (spring).	3 leaf expanded to early flag leaf; milk stage to full maturity	3 leaf expanded to early flag leaf; milk stage to full maturity	3 leaf expanded to early flag leaf	3 leaf expanded to early flag leaf
Corn	Before 15 cm tall; after 15 cm, directed spray	--	Before 15 cm tall; after 15 cm, directed spray	Before 15 cm tall; after 15 cm, directed spray
Flax	5 cm to early pre-bud	5 cm to early pre-bud	5 cm to early pre-bud	5 cm to early pre-bud
Grasses (estab.)	Before crop growth starts in spring	Before crop growth starts in spring	--	--
Legume* seedlings	--	--	Before 10 cm tall	--
Oats	up to flag leaf	up to flag leaf	2-6 leaves	up to flag leaf
Pea (field, processing)	10-18 cm tall	--	--	10-18 cm tall
Rye (fall), wheat (winter).	Before flag leaf in spring	Before flag leaf in spring	Before flag leaf in spring	Before flag leaf in spring
Underseeded legumes*	Before 10 cm tall	Not recommended	Before 10 cm tall	Before 10 cm tall

estab. = established ***NOT on Flemish types of alfalfa or sweet clover.**

7. HOW TO APPLY:

With: Aircraft or Ground equipment.

Rate:

Crop	MCPA Amine	MCPA Ester	MCPA K-Salt	MCPA Na-Salt
Alfalfa + grasses (estab.)	0.4-1.01 L/ac	445-810 mL/ac	Legumes 505 mL/ac	Legumes 710 mL/ac
Asparagus	1.4 L/ac	1.4 L/ac	-	-
Barley, rye, wheat, oats (Not underseeded)(Group I weeds)	280-445 mL/ac	280-445 mL/ac	375-505 mL/ac	485-710 mL/ac
(Group II weeds)	505-710 mL/ac	505-710 mL/ac	610-810 mL/ac	810-1200 mL/ac
(Group III weeds)	-	-	850 mL/ac	1.4-1.8 L/ac
Cereals underseeded to legumes	140-300 mL/ac	-	285-445 mL/ac.	405-605 mL/ac
Corn	up to 445 mL/ac	-	505 mL/ac	up to 705 mL/ac
Flax	up to 445 mL/ac	up to 445 mL/ac	605-850 mL/ac	up to 705 mL/ac
Legume seedlings	-	-	285-445 mL/ac	-
Non-crop areas	1.0-2.0 L/ac	1.6 L/ac	-	2.85 L/ac
Pasture, rangeland, turf.	1.1-1.7 L/ac	0.6-1.1 L/ac	-	legumes 710 mL/ac no legumes 2.85 L/ac
Peas	110-280 mL/ac	-	-	20-605 mL/ac

Water Volume: Aircraft - 12 L/ac minimum. Ground - 40 L/ac; Peas - 70 L/ac minimum (amine), 60 L/ac minimum (Na Salt); Pasture, rangeland, turf - 180 L/ac.

Pressure: Air: 235 kPa or less; Ground: 200-275 kPa

8. APPLICATION TIPS: • Recommendations vary from label to label, READ LABEL of product used. • Do not spray when air temperature is above 27°C. • Extremely hard water may reduce performance or cause problems in spraying the product. • Do not use on bentgrasses, sweet clover, or Flemish types of alfalfa.

9. HOW IT WORKS: A systemic, absorbed by leaf and stem surfaces and translocated to the actively growing regions. MCPA disrupts cell division, causing abnormal growth response, thereby affecting respiration and food reserves.

10. EXPECTED RESULTS: ***Weeds:*** Weeds start to twist between 2-20 days after spraying, depending on weather conditions, formulation and weeds. Following the twisting and bending, plants will turn brown and then die. Only emerged weeds will be controlled. ***Crops:*** Yellowing and thinning of the crop may be noticed if higher than recommended rates are used. ***Poor results may occur if:*** extremely hard water is used.

11. EFFECTS OF RAINFALL: Rain within 2 hours of application will decrease activity.

12. MOVEMENT IN SOIL: Readily leached from soil. Longer residual in dry soil.

13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Danger from drift with amine and salts is lower than from esters. ***Grazing Restrictions:*** Do not graze dairy cattle within 7 days after spraying.

14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (700). Very toxic to fish.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SALT AND AMINE FORMULATIONS SWALLOWED - induce vomiting (see page 6). IF ESTER FORMULATIONS SWALLOWED - do NOT induce vomiting. Get medical attention in all cases.

16. STORAGE: If frozen, warm to 5°C and mix well before using.

MECOTURF (mecoprop)

May & Baker

1. FORMULATIONS: Liquid; 150 g/L; 4 L, 8 L containers.
2. REGISTERED MIXES: None.
3. CROPS: Barley (9.0), lawns, oats, turf, wheat (durum, spring)(8.3). ***Underseeding:*** Not recommended
4. WEEDS CONTROLLED:

buttercup	cleavers	dandelion	plantain
chickweed (7.6)	clover	medic, black	spurry, corn (7.3)

5. WEEDS SUPPRESSED: Canada thistle (4.6)
6. WHEN USED: ***Crop:*** 3 leaf to early flag leaf. ***Weeds:*** 2-4 leaf and mature plants.
7. HOW TO APPLY:
   With: Ground equipment
   Rate: Cereals - 2.2-2.8 L/ac. Lawns, turf - 2.2-3.4 L/ac Low rate for seedling weeds. High rate for mature weeds.
   Water Volume: Cereals - 80-120 L/ac. Lawns, turf - 80-160 L/ac
   Pressure: 300 kPa
8. APPLICATION TIPS: • Recommended water volume is essential for optimum weed control.
   • Cold weather and drought may cause a delay in weed control action.
   • Do not spray bentgrass when temperatures are above 27°C, particularly if high rates are used.
9. HOW IT WORKS: A systemic, which disrupts the plant's translocation system causing the accumulation of plant food in the shoots and subsequent starvation of the roots.
10. EXPECTED RESULTS: ***Weeds:*** Leaf curling and stem twisting should be visible within 4-5 days after spraying. Weeds should be dead within 3-4 weeks of application. ***Crop:*** Deformed heads, missing florets, and twisted awns could result if recommendations are not followed or if crop is under stress conditions.
11. EFFECTS OF RAINFALL: Rain within 4-6 hours will reduce effectiveness.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze within 14 days of application. ***Drift:*** Danger of vapor drift is low. ***Crop Use After Hail:*** No restrictions if 14 days after application. ***Succeeding Crops:*** No restrictions.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,060).
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store above 0°C. If stored for 1 year or longer, shake well before using.

NATA (sodium TCA)

Hoechst

1. FORUMLATIONS: Pellets; NaTA Grass Killer; 85%; 25 kg bag. Liquid; NaTA Liquid; 500 g/L; 20 L pail.
2. REGISTERED MIXES: Buctril M, MCPA Amine 500; MCPA Sodium 300; 2,4-D Amine 500; 2,4-D Ester (Brush only). ***Mixing Instructions:*** Put at least 10 L of water in the tank for each kg of TCA, agitate to dissolve. Ensure that TCA is dissolved before adding another herbicide.
3. CROPS:

barley (9.0)	beets, sugar	flax (8.6)	oats
beets, red	canola (8.7)	non-crop areas	peas, field only (7.0)

4. WEEDS CONTROLLED: Green foxtail (6.9), yellow foxtail (6.9), balsam fir, pine, spruce.
5. WEEDS SUPPRESSED: Quackgrass, Kentucky blue grass, smooth bromegrass.
6. WHEN USED: Foxtail - 1-3 leaf; Quackgrass - no stage limitation. Barley, canola, flax, oats - 2-4 leaf. Field peas - 10-20 cm tall. Sugar beets - post-emergent before 4 leaf. Red beets - pre-emergent. Flax - 10-15 cm tall.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate:

Crop	Granular	Liquid	Non-crop Areas	Granular	Liquid
Barley	0.5 kg/ac	0.87 L/ac	Brome, Kentucky Blue (suppression)	5.0-7.0 kg/ac	8.6-12.1 L/ac
Beets (red) pre	2.5-4.0 kg/ac	4.5-6.9 L/ac	Pavement maintenance	2.5 kg/100 m²	4.25 L/100 m²
			Quackgrass	44.5 kg/ac	75.7 L/ac
Beets (sugar) post	1.8 kg/ac	3.1 L/ac	Quackgrass patches, undisturbed	100-125 g/10 m²	0.2-2.1 L/10 m²
Canola, flax, peas (field).	1.8 kg/ac	3.1 L/ac	Fir (balsam), pine, spruce.	20-25 kg/ 1000 L water	13.8-16.2 L/ac
Oats	0.5-1.1 kg/ac	0.87-1.9 L/ac			

   Water Volume: 40-60 L/ac in all cases except for woody plant control. Apply to point of run-off for spruce, fir and pines.
   Incorporation: For quackgrass cultivate or disc thoroughly after application.
   Pressure: 275 kPa
   Nozzles: Flat fan nozzles, use minimum 50 mesh screens. Stainless steel nozzles are recommended because of corrosiveness.
8. APPLICATION TIPS: • Flush sprayer thoroughly after each use to prevent corrosion. • Plant barley and oats at least 5 cm deep to avoid crop injury.
9. HOW IT WORKS: Absorbed more readily through roots than foliage. Precipitates proteins in the plants and disrupts the membranes.
10. EXPECTED RESULTS: Leaves die and plant dries up. Chlorosis, then browning of the leaf tips, growth retardation and eventual death. ***Poor results may be expected if:*** the soil is dry at application time and for a 2-3 week period after or there is inadequate mixing.
11. EFFECTS OF RAINFALL: A light rain after application is beneficial for activation. Heavy rain may wash TCA off foliage.
12. MOVEMENT IN SOIL: Movement is greater in sandy soils.
13. GRAZING AND CROPPING RESTRICTIONS: Do not feed tops of sugar or red beets to livestock. Do not allow animals to graze treated areas. Do not contaminate water bodies.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,320). Skin and eye irritant. Non-toxic to birds and fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) plus goggles and gloves to reduce exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention.
16. STORAGE: Dry storage, no effect from freezing. A minimum of 2 years shelf life.

PARDNER (bromoxynil)
May & Baker

1. FORMULATIONS: Emulsifiable Concentrate; 280 g/L; 8 L jug.

2. REGISTERED MIXES: Atrazine; Avenge; Avenge + MCPA ester; Hoe-Grass 284; MCPA (amine, ester, K salt); Roundup; TCA; TCA + MCPA; 2,4-D (amine, ester). ***Mixing Restrictions:*** Add amine 2,4-D; MCPA; or Atrazine to water first and then add Pardner. Do not use oil or surfactant when mixing Atrazine.

3. CROPS:

barley (9.0)	triticale (8.9)	***Seedling grasses grown for seed***	reed canary grass
canary grass (9.0)	wheat [durum (8.9),	brome grass	wild rye, Russian (9.0)
corn, field (9.0)	spring (8.9), winter]	fescue [creeping red,	timothy
corn, sweet (7.9)		meadow (8.3)]	wheatgrass (8.5)
oats		orchard grass (8.9)	(crested, intermediate,
rye, fall			slender, tall)

Underseeding: legumes not recommended.

4. WEEDS CONTROLLED:

buckwheats (Tartary,	groundsel, common (9.0)	mustard, wild (8.5)	smartweeds, annual (8.1)
volunteer, wild)(8.4)	kochia (8.2)	nightshade, American	stinkweed (8.4)
bluebur	lady's-thumb	pigweed, redroot (7.9)	thistle, Russian (8.4)
cockle, cow (7.0)	lamb's-quarters (8.4)	ragweed, common	
cocklebur			

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***Weeds:*** Seedling to 4 leaf stage except Russian thistle to 5 cm tall. Buckwheats, common groundsel, lamb's-quarters up to 8 leaf. Generally best results if weeds are in seedling stage. Weed leaf stages vary with different tank mixes. ***Crops:*** Barley, oats, triticale, wheat - 2 leaf to early flag leaf. Use tank mix with 2,4-D on barley or wheat after 4 leaf. Canary seed grass - 3-5 leaf. Corn - used alone or with atrazine - 4-8 leaf. Beyond 8 leaves, then use alone with drop pipes. Rye (fall), wheat (winter) - first growth to early flag leaf. Seedling grasses, grown for seed - 2-4 leaf. Wheat (winter) - fall 2-4 leaf.

7. HOW TO APPLY: Ground equipment. Spra-coupes - not recommended.
Rate: Barley, corn (field, sweet), oats, triticale, wheat - 400-500 mL/ac. Canary seed, rye (fall), seedling grasses (grown for seed) - 400 mL/ac.
Water Volume: 40 L/ac; Corn - 80-120 L/ac; Seedling Grasses - 60 L/ac.
Incorporation: Not applicable.
Pressure: 275 kPa
Nozzles: Flat fan recommended.

8. APPLICATION TIPS: Tank mix directions may vary from those of Pardner alone.

9. HOW IT WORKS: A contact herbicide so good coverage is essential. Inhibits respiration and photosynthesis causing death.

10. EXPECTED RESULTS: ***Weeds:*** turn brown and die within 3-5 days, more rapidly under good growing conditions and when applied to seedling weeds. ***Poor results can be expected if:*** weeds past 4 leaf stage, poor spray coverage or, lower than recommended rate used. Injury to corn may occur if under stress.

11. EFFECTS OF RAINFALL: None.

12. MOVEMENT IN SOIL: None.

13. GRAZING AND CROPPING RESTRICTIONS: None.

14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (245). Very toxic to fish, snails, and slugs.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). ***Symptoms of poisoning:*** such as stomach cramps, diarrhea, sore throat may appear. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Does not require heated storage.
NOTE: A similar product, Torch DS, is listed on page 97.

PATORAN (metobromuron)
BASF

1. FORMULATIONS: Liquid Suspension; Patoran FL; 400 g/L; 10 L jug.
2. REGISTERED MIXES: Dual Ciba-Geigy 960E. ***Mix Restrictions:*** Not compatible with emulsifiable concentrates.
3. CROPS: Beans [dry (kidney, white, yellow-eye), adzuki, lima, snap (except Slim Green)], potatoes, soybeans.
4. WEEDS CONTROLLED:

bluegrass, annual	groundsel	nightshade, black	shepherd's-purse
chickweed	lady's-thumb	pigweeds	smartweeds, green
foxtail, green	lamb's-quarters	purslane	spurry, corn
grass, barnyard	mustards	ragweed	stinkweed.

5. WEEDS SUPPRESSED: Annual grasses.
6. WHEN USED: Post-plant but pre-emergent to crop and weeds. - Patoran can be applied either as:
   (a) A pre-emergent spray in tank mix combination with Dual Ciba-Geigy.
   (b) A pre-emergent spray preceded by a pre-plant incorporated spray of Dual Ciba-Geigy.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate:

Crop	Sandy Loam Soils L/ac	Clay, Muck Soils L/ac
Beans (adzuki)	1.7	1.7-2.2
Beans (dry, lima, snap)	1.4	1.7
Potatoes	1.7-2.2	2.2-2.8; 3.4 on mucks with grass problems.
Soybeans	1.7	1.7-2.2

   Do not use on the bean variety "Slim Green". Use 1.1 L/ac for the bean varieties: "Yellow-Eye" "Cranberry", "White Kidney", "Light-Red Kidney", and "Dark-Red Kidney".
   Water Volume: 100-160 L/ac.
   Incorporation: Do not soil-incorporate Patoran.
   Pressure: 275 kPa
   Nozzles: Nozzle screens should be 50 mesh or larger.
8. APPLICATION TIPS: • Do not let spray tank mixture stand without agitation before use. • Keep by-pass line on or near the bottom of spray tank to prevent foaming. • Do not apply Patoran to sandy soils of less than 2% organic matter.
9. HOW IT WORKS: Absorbed through the roots, inhibits photosynthesis.
10. EXPECTED RESULTS: Weed emergence will be inhibited or absent. Under dry conditions, some weed emergence and early die back can occur.
11. EFFECTS OF RAINFALL: Enhance efficacy. Shallow planted crops may be injured if heavy rain follows application.
12. MOVEMENT IN SOIL: Patoran can be leached on light soils.
13. GRAZING AND CROPPING RESTRICTIONS: Not applicable.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,000). Non-toxic to fish and birds. Slightly toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce skin exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - do NOT induce vomiting. Get medical attention. Get immediate medical attention.
16. STORAGE: Flowable formulations should be kept in warm storage. If frozen, warm thoroughly then agitate to resuspend.

POAST (sethoxydim)
BASF

1. FORMULATIONS: Emulsifiable Concentrate; 184 g/L; 2 X 7 L Poast + 1 X 7 L Assist Oil Concentrate.

2. REGISTERED MIXES: Bladex TTC (triazine tolerant canola only), Brominal M, Bromox 720 M, Buctril M, Lontrel, MCPA (Amine or Ester), Sabre. BASF Power Pack (2 x 10.6 L liquid ammonium sulphate + 3.4 L Assist).
Mixing Instructions: Assist Oil Concentrate must be added to all applications of Poast.

Usual Mix Order -		Mix Order Exceptions -		
1) Poast,	2) broadleaf herbicide,	1) Bladex TTC,	2) Poast,	1) ammonium sulphate,
2) broadleaf herbicide,	3) Assist.	2) Poast,	3) Assist.	2) Poast,
3) Assist.		3) Assist.		3) Assist.

3. CROPS: Beans [dry (kidney, pinto, white), snap], canola (including triazine tolerant varieties), flax, onions (dry bulb), peas (dry), potatoes, soybeans, sugar beets, tomatoes.

4. WEEDS CONTROLLED:

barley, volunteer (8.5)	foxtail (green, yellow)(8.3)	oats (volunteer, wild)(8.4)	quackgrass
corn, volunteer (7.0)	grass, barnyard (8.6)	proso millet, wild	wheat, volunteer spring (8.4)
darnel, Persian (8.7)			

5. WEEDS SUPPRESSED: None.

6. WHEN USED: Controls weeds in 1-6 leaf stage, optimum is 2-5 leaf (10-15 cm tall). Quackgrass up to 3 leaf (8-12 cm tall).

7. HOW TO APPLY:
With: Aircraft or Ground equipment.
Rate: Rates refer to Poast only. **Do not use quackgrass rate on canola or snap beans.**

Weeds	Rate	Power Pack Rate
Barnyard grass, foxtail, darnel, volunteer corn.*	325-405 mL/ac	-
Wild oats + above weeds.	570-650 mL/ac	570 mL/ac
Volunteer cereals + above weeds.	650 mL/ac	570 mL/ac
Volunteer barley (heavy infestations)	770 mL/ac	570 mL/ac
Quackgrass + above weeds.	1.7 L/ac	1.09 L/ac

NOTE:* Only on onions, soybeans, sugar beets - 1 repeat of 325 mL/ac if necessary for second flushes.
Water Volume: air - 10-20 L/ac+200-400 mL/ac Assist. Ground - 20-44 L/ac+200-400 mL/ac Assist. Dense foliage, heavy infestations, quackgrass control 44-80 L/ac+810 mL/ac Assist.
Pressure: Air 200 kPa. Ground 240 kPa with low water volumes; 275-425 kPa with higher water volumes.
Nozzles: Flat fan only recommended, tilt forward 45° for better coverage.

8. APPLICATION TIPS: • Treat when weedy grasses are actively growing, there is good soil moisture and crop is small enough to permit thorough spray coverage. • If annual grass weeds and broadleaf weeds are not in the correct stages for treatment, apply separate applications of each herbicide. • Control of grasses growing under drought, flooding or prolonged cool temperatures under 15°C, may be reduced or delayed. Escapes or re-tillering may occur under prolonged stress conditions. DO NOT APPLY ON GRASSES STRESSED LONGER THAN 20 DAYS DUE TO LACK OF MOISTURE AS UNSATISFACTORY CONTROL WILL RESULT. • Do not apply where runoff or erosion is likely. • In wide row crops the quackgrass treatment should be followed by a cultivation after a minimum of 7 days. • Allow 4 days between application of Poast and any other chemical. • Ammonium sulphate is corrosive to metal. Do not allow mixtures to stand. • Thoroughly clean sprayer after use by flushing with water and detergent.

9. HOW IT WORKS: Absorbed by foliage and translocated to the growing points. Inhibits certain vital metabolic processes in these tissues.

10. EXPECTED RESULTS: Weeds stop growing immediately, gradually turn brown and die within 7-21 days.

11. EFFECTS OF RAINFALL: Rainfall 1 hour after application may reduce effectiveness.

12. MOVEMENT IN SOIL: Not applicable.

13. GRAZING AND CROPPING RESTRICTIONS: Do not graze treated fields or harvest for feed prior to crop maturity.
Succeeding Crops: No restriction.

14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rate (mg/kg) = formulation (2,500). Causes moderate skin and eye irritation. Low toxicity to birds, fish and bees. Hazards to the environment are low because of rapid breakdown in soil.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) plus goggles and gloves to reduce skin and eye exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention immediately for eyes. IF SWALLOWED - do NOT induce vomiting. Get immediate medical attention.

16. STORAGE: Store product in a cool, dry place. Freezing will not reduce effectiveness.

PRIMATOL (atrazine)

Ciba-Geigy

1. FORMULATIONS: Granular; Primatol Nine-0; 90%; 2 X 10 kg pack. Liquid; Primatol Liquid 480; 480 g/L; 2 X 10 L pack.
2. REGISTERED MIXES: Diuron + simazine; paraquat; simazine; 2,4-D.
3. CROPS: Non-crop areas only.
4. WEEDS CONTROLLED: Non-selective.
5. WEEDS SUPPRESSED: Horsetail, milkweed.
6. WHEN USED: April and May OR August to freeze-up. **NOTE:** Spring application can be extended into June, sometimes July, if soil moisture is plentiful, or paraquat is added.
7. HOW TO APPLY:
   With: High volume equipment.
   Rate:

	Primatol Liquid 480		Primatol Nine-0	
	L/ac	mL/100 m²	kg/ac	g/100 m²
Annual weeds, perennial seedlings	9.4	225	5.1	125
Shallow-rooted perennials	14.4	350	7.7	190
Heavy perennial growth	18.9	475	10.1	250

   Water Volume: 220-890 L/ac (50-100 L/100 m²). The lower volume of water should be used only by experienced operators.
   Incorporation: See "Soil Sterilants" page 3.
8. APPLICATION TIPS: See "Soil Sterilants" page 3.
9. HOW IT WORKS: Primatol is taken up mainly by roots and to a lesser degree through foliage.
10. EXPECTED RESULTS: Weeds fail to emerge or, die back soon after emergence.
11. EFFECTS OF RAINFALL: Moderate rainfall can enhance performance. Very heavy rainfall on sandy soils can cause leaching and thus a decrease in efficacy. Lack of precipitation may reduce or delay the effect.
12. MOVEMENT IN SOIL: Low solubility, low leachability, but there may be some physical movement on sloping ground.
13. GRAZING AND CROPPING RESTRICTIONS: Not applicable.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{∞} rats (mg/kg) = active ingredient (3,080). May cause eye irritation. Non-toxic to fish and birds. May be toxic to bees.
15. PRECAUTIONS, FIRST AID: Do not spray on foraging bees. Wear standard protective clothing (see page 4) including goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: In a dry location.

PRIMEXTRA (metolachlor + atrazine)

Ciba-Geigy

1. FORMULATIONS: Flowable; 300 g/L metolachlor + 190 g/L atrazine + 10 g/L related active triazines; 2 X 10 L pack, 1 X 110 L container.
2. REGISTERED MIXES: Banvel. Nitrogen fertilizer solutions may replace all or part of the water carrier. Dry granular phosphate fertilizers may be impregnated with Primextra. ***Mixing Instructions:*** add chemical while filling tank with water - gently agitate while filling, mixing, spraying.
3. CROPS: Corn (field, silage, sweet).
4. WEEDS CONTROLLED:

buckwheat, wild	lady's-thumb	nightshade, American	ragweed
foxtail (green, yellow)	lamb's-quarters	pigweed (prostrate, redroot)	smartweeds, annual
grass, barnyard	mustard, wild	purslane	

5. WEEDS SUPPRESSED: None
6. WHEN USED: Spring applied - pre-plant incorporated or banded. Pre-emergent (under irrigation only).
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 2.6-3.4 L/ac. Infestation Level: Light 2.6 L/ac; Medium 2.9 L/ac; Heavy 3.4 L/ac.
   Water Volume: 60-120 L/ac
   Incorporation: Broadcast and lightly harrow before planting. Do not exceed 5 cm depth. Band treatment: mount a press wheel ahead of the nozzle to level the band.
   Pressure: 200-300 kPa
8. APPLICATION TIPS: • Use metal filters and screens 50 mesh or larger.
   • Dry granular fertilizer may be impregnated for pre-plant, incorporated application.
9. HOW IT WORKS: Absorbed by roots and inhibits photosynthesis.
10. EXPECTED RESULTS: Weeds die at germination or under dry conditions die-back soon after emergence.
11. EFFECT OF RAINFALL: Enhances results.
12. MOVEMENT IN SOIL: Negligible lateral movement.
13. GRAZING AND CROPPING RESTRICTIONS: Follow corn with corn only.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,100). May cause severe skin irritation and perhaps eye injury. Low toxicity to fish and birds.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Dry heated storage preferred.

PRINCEP NINE-T(simazine)

Ciba-Geigy

1. FORMULATIONS: Water Dispersible Granule; 89% simazine + 1% related triazines; 1.5 kg bag.
2. REGISTERED MIXES: None
3. CROPS:

alfalfa, established	blueberries, high bush	pears	tree plantings (forest, Christmas)
apples	corn (field, sweet)	raspberries	trefoil, bird's-foot (established)
asparagus	loganberries	shelterbelts	woody ornamentals, established
blackberries	nursery stock		

4. WEEDS CONTROLLED:

buckwheat, wild	grass, barnyard	oats, wild	smartweeds, annual
clovers, volunteer	lady's-thumb	purslane	most perennial species starting freshly
foxtail, yellow	lamb's-quarters	ragweed	from seed

5. WEEDS SUPPRESSED: None
6. WHEN USED: Prior to or during weed emergence. May be applied in either the spring or fall, prior to freeze-up.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate:
   (On Established Stands Only)
   Nursery stock, woody ornamentals: 1-1.5 kg/ac. Shelterbelts: 2-3 kg/ac (both - fall or spring prior to weed emergence). Christmas tree and woodland plantations: 2-2.8 kg/ac. Alfalfa, bird's-foot trefoil: 0.45 kg/ac (late fall). Corn: 0.6-1 kg/ac (within 3 days of seeding). Asparagus, blackberries, blueberries: 1-1.5 kg/ac. (early spring). Raspberries: 0.8-1 kg/ac. (early spring but not on young shoots). Loganberry: 1.5-2.4 kg/ac. Bearing and non-bearing apples and pears: 1-2 kg/ac (spring - prior to weed emergence).
   Water Volume: 120 L/ac. except 200 L/ac for shelterbelts.
   Incorporation: In corn, Princep may be applied 1 week before seeding and incorporated to a depth of 2.5 cm.
   Pressure: 275 kPa
8. APPLICATION TIPS: • Use nozzle screens of 50 mesh or larger.
   • Gentle agitation required during mixing and spraying. After any break in the spray application, agitate thoroughly.
   • Alfalfa, bird's-foot trefoil: Do not apply to the same field for more than 3 consecutive years. Do not apply Gramoxone within 1 year after the Princep application.
9. HOW IT WORKS: Acts through the roots of germinating weeds and inhibit photosynthesis.
10. EXPECTED RESULTS: Weed free ground.
11. EFFECTS OF RAINFALL: Negligible
12. MOVEMENT IN SOIL: Very little movement is possible on clay soil but on sandy ground with high rainfall some leaching may occur.
13. GRAZING AND CROPPING RESTRICTIONS: Allow 30 days between application and grazing of dairy, beef cattle, and sheep and 60 days between application and cutting for hay. ***Succeeding Crops:*** Do not plant any crop in the treated area in the same year except corn.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,000) technical. May be irritating to eyes and cause dermatitis.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles when using. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6).
16. STORAGE: Store in dry area, heating not required.

REGLONE (diquat)

Chipman

1. FORMULATIONS: Liquid; 200 g/L; 10 L container.
2. REGISTERED MIXES: Agral 90 (surfactant). Mixing with other pesticides: Not recommended
3. CROPS:

alfalfa	flax	peas	soybeans
beans (adzuki, kidney, red, white)	mustard	potatoes	sunflowers, all
clover (Dutch, red, white)	oats	rapeseed	trefoil, bird's-foot

4. WEEDS CONTROLLED: Non-selective for green vegetation, used for weed control and crop desiccation for harvest.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: For crop desiccation. ***Alfalfa, bird's-foot trefoil, clover (red, white)(for seed):*** By air no more than 7 days prior to harvest. ***Beans (adzuki, kidney, red, white), soybeans:*** By air or ground when 80-90% of natural leaf defoliation of beans has occurred. Treatment does not mature beans but removes green weeds. ***Flaxseed:*** By air when crop has reached 75% ball turn. ***Mustard:*** By air when 75% of the seeds have turned. ***Peas (dry, field):*** By air when the crop is mature. Treatment will not mature peas but will kill green weeds in the crop. ***Potato Vines:*** By air or ground 2 weeks before harvest. ***Rapeseed:*** By air when 60-75% of the seeds have turned from green to brown. ***Sunflowers:*** By air at 20-50% moisture.
7. HOW TO APPLY:
   With: Aircraft or Ground equipment. Booms on ground equipment must be high enough to ensure proper coverage of foliage.
   Rate: Agral 90 at 1 L/1,000 L spray mixture. ***Alfalfa, bird's-foot trefoil, clover (red, white)(for seed):*** 810-1300 mL/ac in 90-220 L/ac of water. Add Agral 90. ***Bean, soybeans:*** light-moderate weed infestation 810 mL/ac; moderate-heavy weed infestation 1.1 L/ac; minimum 120 L/ac water. Add Agral 90. ***Flax, mustard, rapeseed:*** light stands, maturing evenly and fields free from weeds, 810 mL/ac in 20 L/ac water. Heavy stands on fields which contain weeds, 1.1 L/ac in 20 L/ac of water. Add Agral 90. Argentine varieties should only be desiccated to facilitate harvest of lodged crops. Losses can occur due to pod drop and shatter from handling, and under unfavorable weather conditions. Polish varieties may be straight combined. ***Peas:*** If green weeds are present 810-1100 mL/ac in 20 L/ac of water. Add Agral 90. ***Oats:*** Corn spurry control,up to 8 cm tall 445 mL/ac; more than 8cm tall 607 mL/ac in 90-135 L/ac water. ***Sunflowers:*** 600 mL/ac in 20 L of water. Add Agral 90.
   Water Volume: Aircraft - 18 L/ac. Ground - 100-400 L/ac. Higher spray volumes generally give better results.
   Pressure: 275-400 kPa
   Ground Speed: 9 km/h
   Nozzles: All types.
8. APPLICATION TIPS: • Muddy water will reduce effectiveness. • Applications made on cloudy days or just prior to or during periods of darkness will increase effectiveness.
9. HOW IT WORKS: Reglone is absorbed by all leaf and stem surfaces, non-systemic. Interferes with photosynthesis.
   WARNING: User must be aware that Reglone speeds up crop maturity. In case of adverse weather (heavy rain, hail or strong winds) the resultant damage to crops may be enhanced.
10. EXPECTED RESULTS: ***Weeds:*** Fast and virtually complete top kill of annual weeds. Yellowing starts within a few hours of application. Desiccation of the plant will continue rapidly till death. ***Crops:*** Leaf kill will occur within a few days of application. Stem fall will take longer depending on the crop, but harvesting should normally commence within 7-14 days.
11. EFFECTS OF RAINFALL: No effect once the spray solution has dried.
12. MOVEMENT IN SOIL: Inactivated on contact with soil, therefore, has no residual effect.
13. GRAZING AND CROPPING RESTRICTIONS: No waiting period after use before straw may be fed to livestock.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (230). **Has the potential to cause eye damage, if eyes are constantly exposed.** May cause oral and nasal irritation shortly after use. Does not cause lung damage.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) plus a respirator, goggles and rubber gloves. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes immediately. IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately.
16. STORAGE: Heated storage is necessary.

RIVAL (trifluralin)
Hoechst
(Cereals)

1. FORMULATIONS: Emulsifiable Concentrate; Rival; 500 g/L; 9 L jug. Granular; Pival 10G; 10.0% 22.7 kg bag.
2. REGISTERED MIXES: Rival EC - Avadex BW, Avadex BW+liquid fertilizer, liquid fertilizer. ***Mix Restrictions:*** Add Rival EC or Rival EC+Avadex directly into the liquid fertilizer, mix thoroughly and apply immediately after mixiing. Agitate until application is complete.
3. CROPS: ***Rival 500:*** Barley, wheat (durum, spring). ***Rival 10G:*** Barley only. ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED: Green foxtail.
5. WEEDS SUPPRESSED: None
6. WHEN USED: ***Rival 500:*** Alone or with Avadex BW in the spring only after seeding and prior to emergence of crop. **Rival 10G:*** Fall only.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 485 mL/ac on light to medium textured soil. 650 mL/ac on heavy textured soil.
   Water Volume: 40 L/ac
   Incorporation: Incorporate 2-4 cm with 2 cross harrowings with tyne or diamond harrows operated at a minimum of 9 km/h. Both incorporations should be done within 24 hours of application.
   Pressure: 275 kPa
8. APPLICATION TIPS: • Apply only on fields that are trash free or summerfallow fields. • Crop must be seeded 5-8 cm deep in a well tilled seedbed to prevent contact between the chemical and the seed. • ***Caution:*** Crop injury, delayed maturity or reduced yields, may occur if emerging crops are weakened from factors such as improper seeding depth, excessive moisture, cold temperature, seedling disease, poor soil fertility, drought, or saline soils.
9. HOW IT WORKS: Acts on both the root and shoot tips as they emerge. Prevents cell division and affected plants die before emergence. If the shoot portion of the plant escapes to the soil surface, lateral or secondary root growth is inhibited causing a slow death since the plant is unable to gather moisture or nutrients.
10. EXPECTED RESULTS: ***Green Foxtail:*** Seeds that germinate below the treated layer will produce plants that will emerge. The secondary root system of plants that form within the treated layer is completely inhibited by trifluralin present in that area. The affected plant dies slowly as crop competition and temperature stress over-tax the rootless plant's ability to take up moisture. ***Crop:*** Injury is minimized when seeded to a depth of 5-8 cm.
11. EFFECTS OF RAINFALL: No effect once incorporated into the soil.
12. MOVEMENT IN SOIL: None.
13. GRAZING AND CROPPING RESTRICTIONS: None.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (6,150). In clean water, fish are very sensitive to trifluralin; but in runoff and muddy water, trifluralin binds to the suspended soil particles and large amounts can be tolerated by fish. Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: Do not store below 0°C. If stored below 0°C, bring the contents to 15°C for 24 hours and shake well before using. Do not store near heat, spark or open flame.

***SPECIAL USE: Rival 10G on barley ONLY – Fall application ONLY.**
When Used: Fall application only. September 1 to soil freeze-up.
How to Apply: See Rival 10G under Rival - oilseed.
Rate: Light soils (2-4% O.M.) - 3.4 kg/ac; Medium or heavy soils (4-6% O.M.) - 4.5 kg/ac. Medium or heavy soils (6-10% O.M.) - 5.7 kg/ac. **Warning:** Do not apply Rival 10G for barley on land treated with trifluralin products since June 1 of the previous year. Do not apply to soils with less than 2% O.M. or more than 10% O.M. Seeding should be done into a warm, moist seedbed. Avoid seeding in cold soil. **Caution:** Do not apply to soils subject to erosion.
NOTE: Similar products, Treflan and Triflurex, are listed respectively on pages 100 and 103.

RIVAL (trifluralin)

Hoechst

(Oilseeds, Special Crops)

1. FORMULATIONS: Emulsifiable Liquid; Rival; 500 g/L; 9 L jug. Granular; Rival 10G; 10.0%; 22.7 kg bag.

2. REGISTERED MIXES: Rival EC + liquid nitrogen fertilizer (28-0-0). ***Mix Instructions:*** Pour directly into liquid fertilizer, mix thoroughly and apply as soon as possible with constant agitation.

3. CROPS:

Rival

beans, dry common (only black, kidney, white)
canola, including triazine tolerant
crambe
fababeans
flax
lentils*
mustard
peas (field, canning)
soybeans
sunflower

* Fall application only.

Underseeding: Not recommended.

Transplanted Shelterbelts

ash, green
caragana
elm (American, Siberian)
pine, Scotch

Rival 10G

canola, including triazine tolerant
flax
lentils*
mustard
peas (canning, field)
sunflowers

4. WEEDS CONTROLLED:

bromegrass, downy
buckwheat, wild (8.3)
chickweed (7.1)
cockle, cow (9.0)
darnel, Persian
foxtail (green, yellow)(8.1)
grass [annual blue, barnyard (8.3)]
knotweed
lamb's-quarters (8.0)
oats, wild (7.5)
pigweed (8.2)
purslane
thistle, Russian (7.9)

5. WEEDS SUPPRESSED: None.

6. WHEN USED: ***Spring:*** Rival liquid only. cultivate to destroy existing weeds and apply pre-plant. ***Fall:*** September 1st to freeze-up. Fall incorporation is discouraged where soil drifting is a problem. ***Summer:*** On summerfallow between June 1st to September 1st. ***Lentils:*** Fall application only. Both incorporations of Rival or Rival 10G must be done in the fall. Shallowly till and pack the soil in the spring to ensure a firm seedbed and an accurate depth (2-4 cm) for seeding. ***Flax:*** Summer and fall application only.

7. HOW TO APPLY:

With: Ground equipment

Rate: Rate of Rival liquid in L/ac (Rate of Rival 10G in k/ac).

Season	Sandy Soils (less than 6% organic matter)	Loams to Clay Soils (6-15% organic matter) low-medium wild oat infestation	Loams to Clay Soils (6-15% organic matter) heavy wild oat infestation
Spring	650 mL/ac (-)	890 mL/ac (-)	1.1 L/ac (-)
Fall	890 mL/ac (4.5 kg/ac)	1.1 L/ac (5.7 kg/ac)	1.4 L/ac (6.9 kg/ac)
Summer	1.4 L/ac (5.7 kg/ac)	1.4 L/ac (6.9 kg/ac)	1.4 L/ac (6.9 kg/ac)
Shelterbelts	1.7 L/ac (-)	3.6 L/ac (-)	3.6 L/ac (-)

Water Volume: 40 L/ac

Incorporation: First incorporation in the same direction as application, within 24 hours of application. Second at right angles to the first. A tandem disc, discer or field (vibra shank) cultivator are recommended for incorporating to 8-10 cm. For best mixing action, operate disc implements at 6-10 km/h; cultivators at 10-13 km/h. Deep tillage cultivators are not recommended.

Pressure: 200-275 kPa

8. APPLICATION TIPS: • Do not apply on soils that are wet or subject to flooding, in poor tilth, or contain more than 15% organic matter. Use on soils with less than 20-25% straw cover. • On stubble, chop and thoroughly mix residues and weed growth into the soil, to a depth of 10-15 cm, before application. A tandem disc mixes best on stubble or crusted, lumpy, or wet soil. • To avoid concentrating wild oat seeds below the treated layer, do not plow land prior to trifluralin application. • Fall or summer application should be followed by a light spring tillage to a 5-8 cm depth before seeding.

9. HOW IT WORKS: Kills seedlings as they germinate. Inhibits cell division in the actively growing points of root and shoot.

10. EXPECTED RESULTS: ***Weeds:*** Most weeds die before emerging. Weeds will exhibit swelling in the coleoptile region, stubby, thick primary root development and lack of secondary roots, which leads to death due to inadequate moisture obtaining ability. ***Crop:*** Seed flax into a well packed warm moist seedbed. Do not seed deeper than 4 cm.

11. EFFECTS OF RAINFALL: No effect once trifluralin is incorporated into the soil.

12. MOVEMENT IN SOIL: None.

13. GRAZING AND CROPPING RESTRICTIONS: None. ***Crop Use After Hail:*** No restrictions ***Succeeding Crops:*** Normally, trifluralin carryover will not harm crops grown in rotation. As a precaution, oats, sugar beets and small seeded annual grasses such as timothy, canary seed grass, creeping red fescue should not follow a trifluralin treated crop. Alfalfa and most clovers are tolerant to trifluralin. Drought conditions in the year of treatment may result in higher levels of trifluralin carry-over into the next year. To avoid wheat injury, seed less than 7 cm deep into a warm, moist seedbed.

14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (greater than 5,000). In clean water, fish are very sensitive to trifluralin, but in run off or muddy water, it binds to soil particles and large amounts can be tolerated by fish. Non-toxic to bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Do not store below 0°C. If stored below 0°C, bring the contents to 15°C for 24 hours and shake well before using. Do not store near heat, spark or open flame.
    NOTE: Similar products, Treflan and Triflurex, are listed respectively on pages 101 and 104.

ROUNDUP (glyphosate)

Monsanto

CAUTION CORROSIVE

1. FORMULATIONS: Water soluble liquid; 356 g/L; 1 L, 4 L or 10 L containers.
2. REGISTERED MIXES: ***Zero Till:*** Torch DS + non-ionic surfactant. ***Chemical Fallow:*** 2,4-D amine (or Banvel or Torch DS) + non-ionic surfactant. ***Non-ionic Surfactants:*** Ag-Surf, Agral 90, Triton XR. Mixing with other pesticides: Not recommended
3. CROPS: Fall stubble treatment, non-crop areas, minimum or zero till, pasture renovation, summerfallow.
4. WEEDS CONTROLLED:

Annuals		***Perennials***		***Brush***
barley, volunteer	mustard	bindweed, field (7.2)	quackgrass	alder
bluegrass, annual (9.0)	(volunteer, wild)	bluegrass (Canada,	sow-thistle, perennial	birch
bromegrass, downy	oats, wild	Kentucky)(9.0)	thistle, Canada (7.8)	maple
buckwheat, wild (6.7)	ragweed, common	bromegrass, smooth	toadflax (8.5)	poplar
corn, volunteer	shepherd's-purse	cattail	wormwood	raspberry
foxtail, green (7.9)	smartweeds, annual	cress, hoary		snowberry
knotweed	sow-thistle	dock, curled		willow
kochia	stinkweed	milkweed, common		
lady's-thumb	thistle, Russian			
lamb's-quarters	vetch, wild			
lettuce, prickly				

5. WEEDS SUPPRESSED: flixweed, wild barley.
6. WHEN USED: ***Spring*** - prior to seeding; weed growth at least 20 cm tall (3-4 leaf). ***Stubble/Summerfallow*** - vegetation at least 20-25 cm. Heavy frosts prior to application may decrease control. ***Spot Treatment*** - up to heading of small grains, silking of corn, and emergence of seed heads. Treated crop will be killed. ***Bindweed*** - at or beyond full bloom. ***Canada Thistle*** - at or beyond bud stage (at least 20-25 cm tall); or fall rosette (diameter 15 cm or 5 weeks old). ***Milkweed*** - bud to full bloom. ***Quackgrass*** - at least 20-25 cm tall (3-4 leaf). Do not apply after the first damaging frost in fall. ***Other Perennials*** - most in early head or early bud stage. ***Brush*** - June to August.
7. HOW TO APPLY: **Do not use galvanized steel or unlined steel tanks.**
   With: Ground equipment only - boom equipment, hangun, high volume equipment, wipers.
   Rate: ***Annual Weeds (less than 15 cm tall)*** - 910 L/ac, ***(over 15 cm tall)*** - 1.4 L/ac. ***Bindweed (field)*** - 2.8-4.9 L/ac. ***Canada thistle (bud)*** - 1.9-2.8 L/ac; ***(fall rosette)*** - 1.0 L/ac. ***Milkweed (common)*** - 4.9 L/ac. ***Quackgrass (season long)*** - 1.0 L/ac, ***(long term)*** - 1.9-2.8 L/ac. ***Other perennials*** - 2.8-4.9 L/ac. ***Minimum or Zero Till*** - 445 mL + 350 mL non-ionic surfactant. ***Reduced Rates (Summerfallow)*** - 300-400 mL/ac + 350 mL non-ionic surfactant. ***Brush:*** 1 L/100 L water.
   Water Volume: Handgun, high volume (coarse sprays only) - 80-120 L/ac. Boom - 40-120 L/ac. Chemical fallow, reduced rates: 20-40 L/ac
   Pressure: 275 kPa
   Nozzles: Flat fan nozzles for volumes 20-40 L/ac - flood jet type or flat fan for volumes above 40 L/ac
8. APPLICATION TIPS: • Tillage or mowing prior to application will reduce effectiveness on perennial weeds. Minimum (days) to wait before tillage after Roundup: Annual weeds (3); Spring treatments, quackgrass (5); Canada thistle (bud)(5), rosette (10); Bindweed, milkweed, other perennials (7). ***Quackgrass:*** apply 4-6 weeks after swathing. Sod-bound quackgrass may require follow-up treatment. Frost of -5°C will be tolerated by new shoots. Frost damage to growing shoots could reduce control and the field should be left untilled for spring treatment.

   Frost damage is evident by the drying of new shoots shortly after the frost.
9. HOW IT WORKS: A non-selective, systemic herbicide which moves from the foliage into the roots and kills the entire plant.
10. EXPECTED RESULTS: Wilting and yellowing of annuals occurs within 2-4 days, perennials require 7-10 days. Complete browning of above ground growth and deterioration of roots occurs. Cool or cloudy weather may slow activity.
11. EFFECTS OF RAINFALL: Rainfall within 6 hours may reduce effectiveness. Heavy rainfall within 2 hours after application may wash the chemical off foliage and require retreatment.
12. MOVEMENT IN SOIL: Not applicable
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze treated areas until vegetation turns brown.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (4,320). Eye irritant. Non-toxic to bees, birds, fish.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles to reduce skin and eye exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Heated storage not required.

SABRE, BROMOX 720 (bromoxynil + MCPA)

Union Carbide/Pfizer

1. FORMULATIONS: Emulsifiable Concentrate; 360 g/L bromoxynil + 360 g/L MCPA; Bromox 720 - 6.25 L jug. Sabre - 12.5 L jug;

2. REGISTERED MIXES: Avenge, MCPA Ester 500 (223 mL/ac for hemp-nettle), Poast + Assist.
Mixing Instructions: Avenge - to 1/2 the required water add Bromox 720 or Sabre, agitate, add rest of water, add Avenge.
MCPA Ester 500 - to 1/2 the required water add Bromox 720 or Sabre, agitate, add rest of water, add MCPA.
Poast - to 1/2 the required water add Poast, agitate, add rest of water, add Bromox 720 or Sabre, then add Assist.

3. CROPS: Barley (8.8), canary seed (8.5), flax (8.4), oats (8.8), rye (fall), wheat [durum, spring (8.6), winter].
Underseeding: Not recommended.

4. WEEDS CONTROLLED:

bluebur	flixweed	mustard (8.4) (ball, tumble,	shepherd's-purse
buckwheat	groundsel, common	wild, wormseed)	smartweeds, annual (8.2)
[Tartary, volunteer, wild (8.1)]	knawel	pigweed, redroot (7.9)	stinkweed (8.9)
catchfly, night-flowering	kochia (6.7)	ragweed, common	sunflower, volunteer
chamomile, scentless (7.6)	lady's-thumb	rapeseed, volunteer (8.7)	thistle, Russian (7.4)
cockle, cow (7.8)	lamb's-quarters (8.6)		

5. WEEDS SUPPRESSED: Canada thistle and perennial sow-thistle.

6. WHEN USED: Cereals: 2 leaf to early flag leaf. Winter wheat, fall rye: in spring, after growth begins to early flag leaf. Canary seed: 3-5 leaf. Flax: 5-10 cm tall.

7. HOW TO APPLY:
With: Aircraft or Ground equipment.
Rate: 315 mL/ac.
Water Volume: Air: 8 L/ac minimum. 16-20 L/ac preferred. Ground: 20 L/ac minimum. More for heavy crop canopy or dense weed growth.
Pressure: 275 kPa
Nozzles: Flat fan recommended.

8. APPLICATION TIPS: • Best results are achieved when weeds are sprayed in seedling stage, with good spray coverage. • Avoid spraying during a severe drought. Under conditions of high temperature and humidity, slight discolouration of cereals may occur but no effect on crop yields. • Flax is less tolerant than cereals, therefore do not spray flax in hot humid weather when day time temperatures are over 29°C.

9. HOW IT WORKS: Bromoxynil is a contact type herbicide, therefore, good spray coverage is essential. Inhibits photosynthesis and plant respiration. MCPA is absorbed through leaves and is readily translocated in the plant.

10. EXPECTED RESULTS: Small burnt spots on the leaf can appear within hours, death takes up to 2 weeks. ***Poor results may be expected if:*** Poor coverage. Poor penetration through crop canopy.

11. EFFECTS OF RAINFALL: No effect.

12. MOVEMENT IN SOIL: Not applicable.

13. GRAZING AND CROPPING RESTRICTIONS: No grazing or crop use restrictions.

14. TOXICITY: High mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (365). Very toxic to fish and birds. Non-toxic to bees

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - Do NOT induce vomiting. Get medical attention.

16. STORAGE: Does not require heated storage.
NOTE: A similar product, Buctril M (page 31), has additional registration on the following: ***Crops*** - corn (field, sweet), several seedling grasses grown for seed.

SENCOR (metribuzin)
Chemagro

1. FORMULATIONS: Flowable; Sencor 500 F; 500 g/L; 4 X 5 L pack. Water Dispersible Granular; Sencor 75 DF; 750 g/kg; 4 X 3 kg pack.

2. REGISTERED MIXES: Cereals: Banvel; 2,4-D Amine 500; MCPA Amine 500; or Target. Potatoes: Eptam. Fababeans, triazine tolerant Canola: Treflan 545 EC. ***Mix Instructions:*** Mix Sencor in the tank before adding Treflan. Continually agitate until all the mixture is sprayed. Do not allow the sprayer to stand without agitation. ***Mix Restrictions:*** Do not tank mix with any other pesticide, wetting agent, or surfactant.

3. CROPS:

alfalfa	canola, triazine tolerant[1]	lentils (7.8)	potatoes (8.6)[3]
barley (8.9)	fababeans (8.6)[2]	peas, field	wheat, spring (8.5)

Underseeding: Do not underseed. 1—Non-triazine tolerant canola will be killed. 2—Sencor+Treflan, NOT Sencor alone.
3—Not on Belleisle, Tobique, red skinned varieties, or any early maturing varieties.

4. WEEDS CONTROLLED: (See Treflan label for additional weeds controlled with Sencor+Treflan.)

buckwheat, Tartary (5.3)	hemp-nettle (8.4)	mustard (ball, wild, wormseed)(8.0)	shepherd's-purse
catchfly, night-flowering	henbit (8.0)	pigweed, redroot (7.4)	smartweeds, annual (8.5)
chickweed (8.1)	lady's-thumb	rapeseed, volunteer (non-triazine	spurry, corn (7.1)
groundsel, common	lamb's-quarters (8.4)	tolerant)(8.8)	stinkweed (8.2)
			thistle, Russian (7.2)

5. WEEDS SUPPRESSED: Canada thistle and sow-thistle with Banvel; MCPA; or 2,4-D mixes.

6. WHEN USED: ***Alfalfa (Only Irrigated):*** Sencor - In fall to dormant established stands. Injury may occur if Sencor is applied earlier than 18 months after seeding. ***Barley, wheat:*** Do not use if soil has less than 3% organic matter. Sencor - 2-5 leaf. Banvel Mix - barley, 2-3 leaf; wheat, 2-4 leaf. MCPA Amine Mix - 3-5 leaf. Target Mix - barley, 2-3 leaf; wheat, 2-5 leaf. 2,4-D Amine Mix - 3-5 leaf. ***Canola (Triazine Tolerant):*** Do not use if soil has less than 2% organic matter. Sencor - before weeds are 5 cm tall. Treflan Mix - Do not use if soil has less than 2% or more than 15% organic matter. Pre-plant incorporated, fall or spring. Apply only once per season. ***Fababeans:*** Do not use on muck soils. Treflan Mix - pre-plant incorporated. ***Lentils, peas:*** Do not use if soil has less than 4% organic matter. Sencor - Before vines are 15 cm long and after weeds have emerged but less than 5 cm in height or diameter. Apply only once per crop season. ***Potatoes:*** Do not use on muck soils. Sencor - post-emergent; before weeds are 4 cm tall. Eptam Mix - pre-plant incorporated.

7. HOW TO APPLY: ***Lentils, peas, triazine tolerant canola*** - Do not apply within 3 days after periods of cool, wet or cloudy weather as crop injury may occur. Plant lentils and peas at least 5 cm below the soil surface.
With: Ground equipment.
Rate:
Barley, wheat.

Herbicide(s)	Barley mL/ac(g/ac) +mL/ac	Klondike, Leduc, Johnston Barley mL/ac(g/ac)+mL/ac	Wheat (Spring) mL/ac(g/ac) +mL/ac
Sencor 500 F(75 DF) Alone	110-225(80-150)	110-170(80-110)	110-170(80-110)
Sencor 500 F(75 DF)+Banvel 480	110-170(80-110)+93	not recommended	110-170(80-110)+93
Sencor 500 F(75 DF)+MCPA Amine	110-225(80-150)+345-445	110(80)+345-445	110-170(80-110)+345-445
Sencor 500 F(75 DF)+Target	110-170(80-110)+405-605	not recommended	110-170(80-110)+405-605
Sencor 500 F(75 DF)+2,4-D Amine	110-225(80-150)+345-445	not recommended	110-170(80-110)+345-445

Crop	Sencor 500 F (mL/ac)	Sencor 75 DF (g/ac)	Tank Mixes
Alfalfa (only irrigated)	910	610	No mixes
Fababeans (Spring)	225-345	150-225	Treflan 545 EC 610-810 mL/ac
Fababeans (Fall)	345	225	Treflan 545 EC 810-1050 mL/ac
Lentils	170	110	No mixes
Peas	170-225	110-150	No mixes
Potatoes (post-emergent)*	225	150	Sencor alone
Potatoes (pre-plant)*	225-345	150-225	Eptam 8-E 1.70-2.2 L/ac

*Not on Belleisle, Tobique, red skinned varieties, or any early maturing varieties.

Canola (triazine tolerant), post-emergent application: Sencor 500 F 170 mL/ac. Sencor 75 DF 110 g/ac.

Canola (triazine tolerant)	Sandy Soils		Loam-Clay Soils	
	2-3% OM*	3-6% OM	6-10% OM	10-15% OM
	mL/ac(g/ac)+mL/ac	mL/ac(g/ac)+mL/ac	mL/ac(g/ac)+mL/ac	mL/ac(g/ac)+mL/ac
Sencor 500 F(75 DF) - spring	170 (110)	225 (150)	225-345(150-225)	345 (225)
+Treflan 545 EC - pre-plant	+610	+610	+810-1050	+810-1050
Sencor 500 F(75 DF) - fall	225 (150)	285 (190)	285-345(190-225)	345 (225)
+Treflan 545 EC - pre-plant	+810	+810	+1050-1300	+1050-1300

* =Organic Matter

Water Volume: 40 L/ac - except 70 L/ac for lentils, peas and post-emergent on triazine tolerant canola. Potatoes 40-120 L/ac.

Incorporation: ***Sencor+Eptam*** on potatoes refer to Eptam. ***Sencor+Treflan*** on fababeans and triazine tolerant canola. Apply to soil and incoporate in the same operation, if possible. Must be incorporated within 24 hours. Work twice in different directions. Use a tandem disc, discer or vibrashank type cultivator to cut 8-10 cm deep. Operate disc implements at 7-10 km/h and cultivators at 10-13 km/h. To reduce wheat injury seed less than 7 cm into warm, moist seedbed.

Pressure: 200-275 kPa

Nozzles: Tilt nozzles 45° forward for better spray penetration in post emergent applications.

8. APPLICATION TIPS: • Shake container thoroughly before adding to sprayer tank. • Allow 4-5 days between application of Sencor and post-emergent wild oat herbicides. • Weed control may be reduced if Sencor is applied later than the 5 leaf stage of crop. • Allow 4-5 days after frost for crop to recover before applying Sencor. • Crop may be sprayed when wet with dew. • Crop must be planted at least 5 cm below soil surface. ***Sencor+Treflan:*** • Cultivate to destroy existing weeds before application. On stubble fields, chop and thoroughly mix crop residues into soil to a depth of 10-15 cm. Disc type implements provide the best results. To avoid concentrating wild oat seeds below the treated layer, and causing soil erosion, do not plow (moldboard) land prior to application. • On variable soils with light, sandy areas; some injury may occur on sandy areas if the rate used is for loams-clay soils. On soils with 10% organic matter and higher, broadleaf weed control may not be adequate. Do not apply to wet soils or soils subjected to periods of flooding. Do not incorporate with a field cultivator when the soil is crusted, lumpy or too wet for good mixing action. • Triazine tolerant canola is sensitive to deep seeding so seedbed should be shallowly tilled and packed just prior to seeding in the spring to ensure a firm seedbed and accurate depth of planting.
9. HOW IT WORKS: A systemic herbicide absorbed by leaves and roots and translocated to new growth. Inhibits photosynthesis and the weed turns brown and dies.
10. EXPECTED RESULTS: ***Broad-leaf Weeds:*** Initial yellowing 5-7 days after application, weeds turn brown and die within 14-16 days. Active in soil for a short period and can control new shallow-rooted germinants, like chickweed. ***CROPS:*** In extremely hot weather or frost that occurs within 1-2 days of application, crop will show some yellowing and slight reduction in height. Discolouration disappears in 7-10 days. On Klondike, Johnston and Leduc barley varieties, temporary lightening in colour and reduction in height may occur. Lentils and peas provide little competition against weed growth due to their low growth habit. Under heavy weed infestations or lush growth, control may be poor. ***Triazine tolerant canola:*** Stress such as disease, cold, deep planting, excessive moisture, high salts or drought may weaken seedlings and increase the possibility of damage. Temporary lightening on the margins of cotyledons and a slight delay in development may occur.
11. EFFECTS OF RAINFALL: Rainfall within 6 hours after application may reduce weed control.
12. MOVEMENT IN SOIL: Little leaching occurs in soils with high organic matter.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze or feed treated crop to livestock within 30 days of application (lentils, peas - 70 days) ***Harvest Restrictions:*** Do not harvest for grain within 60 days of application (lentils and peas - 70 days, canola - 75 days). ***Succeeding Crops:*** As a precaution oats, sugar beets, and small-seeded grasses (e.g. timothy, canary seed grass, creeping red fescue) should not be planted following a Treflan mix. ***Succeeding pre-plant applications in fababeans (Sencor+Treflan), potatoes, triazine tolerant canola:*** Celery, cole crops, cucurbits, lettuce, onions, peppers, rapeseed, spinach, sugar beets, sunflowers, table beets, and turnips may be injured if planted in soil treated with Sencor during the year of application and the following crop year. Fall seeded or cover crops such as wheat, oats, and rye may be injured when seeded in the same season as the application of Sencor.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,100). Slightly toxic to fish and birds.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) when working with the product to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: No damage by freezing but avoid large temperature fluctuations. Store in a cool dry place.
NOTE: A similar product, Lexone (page 63), has an additional registration for use on tomatoes.

SIMMAPRIM (simazine)
Ciba-Geigy

1. FORMULATIONS: Water dispersible granule; 89% simazine + 1% related active triazines; 2 X 10 kg pack.
2. REGISTERED MIXES: Amitrol, atrizine, atrizine + diuron, paraquat, sodium chlorate, sodium metaborate.
3. CROPS: Total weed control and bare ground maintenance on non-crop areas.
4. WEEDS CONTROLLED: Most annual and perennial broad-leaf weeds and grasses. Horsetail, milkweed and sedges may require more than 1 treatment.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: Apply before or during weed emergence. Can be applied in fall before freeze up for control of perennial weeds.
7. HOW TO APPLY:
   With: High volume application equipment.
   Rate: 5.0-10.1 kg/ac.

Annual weeds, perennial seedlings	5.0 kg/ac	125 g/100 m²
Light growth of shallow-rooted perennials	7.7 kg/ac	190 g/100 m²
Well established perennials	10.0 kg/ac	250 g/100 m²

   Incorporation: See "Soil Sterilants" page 3.
8. APPLICATION TIPS: See "Soil Sterilants" page 3.
9. HOW IT WORKS: Absorbed through roots only.
10. EXPECTED RESULTS: Failure of weeds to emerge or, depending on weather conditions, weeds may die back after emergence.
11. EFFECTS OF RAINFALL: Average rainfall can enhance performance. Heavy rain, falling before Simmaprim has penetrated into the ground, may wash chemical off the surface of sloping ground.
12. MOVEMENT IN SOIL: Movement in the soil is negligible.
13. GRAZING AND CROPPING RESTRICTIONS: Not applicable - for use on non-crop areas.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,000). May be irritating to eyes and cause dermatitis.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) and goggles to reduce skin and eye exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Store in dry area. Heating not required.

SINBAR (terbacil)

DuPont

1. FORMULATIONS: Wettable Powder; 80%; 2 kg pack.
2. REGISTERED MIXES: None. ***Mixing Instructions:*** Continuous tank agitation required.
3. CROPS: Alfalfa (forage and seed) (8.6). After crop established for at least 1 year.
4. WEEDS CONTROLLED:

barley, wild (7.5)	foxtail, green (7.3)	lettuce, prickly	ragweed, common
bluegrass, annual (8.6)	grass, barnyard (7.2)	mustard, wild	ryegrass, perennial
brome, downy	henbit	pigweed, redroot (8.0)	sow-thistle, annual (8.4)
chickweed, common (8.6)	lamb's-quarters (8.9)	purslane	stinkweed (9.0)

5. WEEDS SUPPRESSED: Dandelion (6.5)(less than 2 years old), quackgrass
6. WHEN USED: Preferably after alfalfa becomes dormant in fall or before growth begins in spring. Do not apply after growth starts, as crop injury may result.
7. HOW TO APPLY:
   With: Ground equipment. Use metal filters, line strainers and screens no finer than 50 mesh.
   Rate: 285-610 g/ac - lower rate on sandy loams to loams; higher rate on clay loams to clay soils.
   Water Volume: 80 L/ac minimum.
   Incorporation: Not applicable.
   Pressure: 275 kPa
8. APPLICATION TIPS: • Do not overlap spray swaths. • To reduce crop injury, do not use on soils with less than 1% organic matter nor on gravelly soils or eroded areas where subsoil or roots are exposed.
9. HOW IT WORKS: Absorbed by roots and inhibits photosynthesis.
10. EXPECTED RESULTS: ***Weeds:*** Kills germinating weeds. Any that emerge will yellow and die. ***Crop:*** No effect on alfalfa if it is dormant at time of application. ***Poor results may be expected if:*** Too little moisture for activation, uneven coverage, rate too low for soil type.
11. EFFECT OF RAINFALL: Moderate rainfall is desirable.
12. MOVEMENT IN SOIL: Some movement under light soil and high moisture conditions.
13. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Most crops sensitive. ***Succeeding Crops:*** Seed no crop within 2 years of last treatment.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5,000). Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Cool, dry storage.

SPIKE (tebuthiuron)

Elanco

WARNING POISON

1. FORMULATIONS: Wettable Powder; Spike 80W; 80%; 2 kg, 10 kg bag. Granular; Spike 5G; 5%; 7 kg shaker box or 20 kg drum.
2. REGISTERED MIXES: None. ***Mixing Instructions:*** Maintain continuous agitation when using Spike 80W. If by-pass agitation is used, the return line should terminate at the bottom of the tank to minimize foaming.
3. CROPS: Non-crop areas only.
4. WEEDS CONTROLLED: Total vegetation control.
5. WEEDS SUPPRESSED: Not applicable
6. WHEN USED: Use throughout the growing season and up to September 15th. Best if applied early in spring.
7. HOW TO APPLY:
   (A) Spike 5G
   With: Shaker box or granular spreader.
   Rate: 44.5-91.0 kg/ac. Apply the higher rates for deep-rooted perennials and for greater residual effect.
   Incorporation: See "Soil Sterilants" page 3.
   (B) Spike 80WP
   With: Ground spray equipment
   Rate: 2.2-4.5 kg/ac. Use higher rates for deep rooted perennial weeds, and for longer term weed control.
   Water Volume: See "Soil Sterilants" page 3.
8. APPLICATION TIPS: • Do not apply where bare ground is undesirable, where soil erosion may be a problem, or on areas where the roots of desirable vegetation may extend. • Clean application equipment thoroughly after use.
9. HOW IT WORKS: Requires rainfall to move into root zone. Absorbed by roots and inhibits photosynthesis.
10. EXPECTED RESULTS: Vegetation will turn brown and die. Speed of kill will depend on root depth and amount of rainfall. Duration of control will depend upon the amount of chemical applied, soil-type and environmental conditions. ***Poor results may be expected from:*** inadequate application rate or application onto frozen ground.
11. EFFECTS OF RAINFALL: Rainfall will activate product, by carrying into the root zone.
12. MOVEMENT IN SOIL: Once moved into the soil by rainfall, will leach vertically with time.
13. GRAZING AND CROPPING RESTRICTIONS: Spike is non-selective residual herbicide, only used on non-crop areas.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (644). Slightly toxic to fish and birds.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6).
16. STORAGE: Store in a dry place.

STAMPEDE CM (propanil + MCPA)

Rohm and Haas

CAUTION POISON

CAUTION CORROSIVE

1. FORMULATIONS: Emulsifiable Concentrate; 360 g/L propanil + 100 g/L low volatile MCPA ester; 11.4 L jug.
2. REGISTERED MIXES: None. ***Mixing Instructions:*** Add 1/2 the required amount of water, add Stampede CM, agitate and add remainder of water. Water used should be 10°C or warmer. Spray within 6 hours of mixing.
3. CROPS: Barley (8.6), canary seed, flax (8.4), oats (8.9), wheat [durum (8.7), spring]. ***Underseeding:*** Not recommended
4. WEEDS CONTROLLED:

bluebur (7.8)	kochia (6.7)	mustard, wild (8.8)	smartweed (8.6)
buckwheat [Tartary (8.6), wild (8.4)]	lady's-thumb	pigweed, redroot (8.8)	shepherd's-purse (9.0)
flixweed (7.4)	lamb's-quarters (8.8)	rapeseed, volunteer (8.8)	stinkweed (8.7)
foxtail (green, yellow)(8.6)			

5. WEEDS SUPPRESSED: None
6. WHEN USED: ***Weeds:*** 1-4 leaf stage. Seedling or rosette stage for bluebur, kochia, flixweed, shepherd's-purse, stinkweed. Green foxtail - when the majority of plants are in the 3 leaf stage or less (less than 2.5 cm tall), effectiveness declines rapidly after the 5th leaf. Under dry conditions (soil moisture is deeper than 5 cm), apply when green foxtail is in the 2-3 leaf stage. ***Crops:*** Cereals - 2-5 leaf stage only. Flax between 5-12.5 cm tall. ***Temperature Effects:*** Do not spray flax when temperatures exceed 30°C. Do not apply when daily maximum temperatures are not expected to exceed 10°C. Under hot, dry and low relative humidity conditions spray during early morning or evening. Avoid spraying if crop is recovering from frost damage or if frost is expected within 24 hours.
7. HOW TO APPLY:
   With: Ground equipment only. Spra-coupe not recommended.
   Rate: 1.1 L/ac
   Water Volume: Field sprayers - 40 L/ac. Floater type equipment - 60 L/ac
   Pressure: 275 kPa
   Ground Speed: 8 km/h field sprayers, 20 km/h or less for floaters.
   Nozzles: Only flat fan nozzles. Flooding nozzles can be used on floaters.
8. APPLICATION TIPS: • Do not apply Stampede CM in fields to which Atrazine has been applied during the previous 2 years. • A 3 day interval is required before or after an application of Stampede CM and another herbicide. • ***Insecticide Intervals:*** Wait a minimum of 5 days for wheat and 10 days for barley before applying Furadan after Stampede CM. Wait a minimum of 14 days before applying dimethoate (Cygon) or Malathion. Decis may be applied anytime before or after Stampede CM. Crops grown from seed treated with dual purpose (fungicide/insecticide) seed dressings may be treated with Stampede CM.
9. HOW IT WORKS: Rapidly absorbed by foliage to cause breakdown of cell walls and cellular metabolism. The MCPA component causes phenoxy-specific symptoms. Activity is essentially contact, and thorough spray coverage is necessary for optimum weed control. Weeds become tolerant beyond the 4 leaf stage as well as under stress conditions.
10. EXPECTED RESULTS: ***Weeds:*** Within 3-5 days, weeds turn brown and have a "burnt off" or dried out appearance. Weeds past the recommended stage will show extensive desiccation, but some green tissue remains and new growth may be generated enough to recover. Weeds emerging after spraying are unaffected. ***Crops:*** Temporary yellowing, and leaf tip burn will usually be more noticable in barley, oats and flax than wheat. These effects disappear 10-14 days after treatment. New growth develops normally and yields are not reduced. Applied under extreme stress conditions, Stampede CM may cause a slight delay in crop maturity, and some suppression of growth in flax. This may be offset by increased yield due to weed control.
11. EFFECTS OF RAINFALL: Rainfall 1 hour after treatment will not affect performance.
12. MOVEMENT IN SOIL: Not applicable
13. GRAZING AND CROPPING RESTRICTIONS: None. ***Drift:*** Danger is low.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,950). Propanil has potential to cause chlorachne - a skin disease in man following prolonged exposure.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce skin exposure since propanil can cause skin problems. ***Symptoms of poisoning:*** giddiness, intoxication and headache. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: Heated storage is not required. If frozen, warm and agitate thoroughly to redissolve crystals.

STAMPEDE 360 (propanil)

Rohm and Haas

1. FORMULATIONS: Emulsifiable Concentrate; 360 g/L; 11.4 L.

2. REGISTERED MIXES: Stampede 360 should NOT be used alone. Glean [barley (only Argyle, Bedford, Klages), wheat (durum, spring)]. MCPA Ester [barley, flax, oats, wheat (durum, spring)]. 2,4-D LV Amine or Ester [wheat (durum, spring)], Decis (see label for rates). ***Mixing Instructions:*** Add 1/2 required amount of water. Add MCPA; 2,4-D; Glean; or Decis. Add Stampede 360, then any required surfactant. Agitate and complete filling. Agitate at least 5 minutes immediately before spraying. Water should be 10°C or warmer. Spray the solution within 6 hours of mixing.

3. CROPS: Barley (8.4), flax (8.4), oats (8.9), wheat [durum (8.7), spring (8.8)].

4. WEEDS CONTROLLED:

Stampede 360 + Glean

buckwheat	flixweed	lamb's-quarters	smartweeds, annual
(Tartary, wild)	foxtail (green, yellow)	mustard, wild (8.0)	stinkweed
chickweed*	hemp-nettle (8.3)	pigweed, redroot	thistle [Canada*(6.6),
cleavers*	kochia*(4.8)	rapeseed, volunteer (8.1)	Russian*(6.2)]
cockle, cow (9.0)	lady's-thumb	shepherd's-purse	

*higher rate of Glean

Stampede 360 + MCPA Ester

bluebur (7.8)	foxtail (green, yellow)(7.6)	mustard, wild (8.8)	smartweeds, annual (8.6)
buckwheat	kochia (6.7)	pigweed, redroot (8.8)	stinkweed (8.7)
[Tartary (8.8), wild (8.4)]	lady's-thumb	rapeseed, volunteer (8.8)	
flixweed (7.4)	lamb's-quarters (8.8)	shepherd's-purse (9.0)	

Stampede 360 + 2,4-D (Amine or Ester)

bluebur	flixweed	lamb's-quarters	rapeseed, volunteer
buckwheat	foxtail (green, yellow)	lettuce, prickly	smartweeds, annual
(Tartary, wild)	goat's-beard	mustard, wild	shepherd's-purse
burdock	hawk's-beard, narrow-leaved	pigweed (redroot, Russian)	stinkweed
clover, sweet	kochia	plantain	sunflower, annual
cocklebur	lady's-thumb	radish, wild	thistle, Russian (7.5)

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***Weeds:*** 1-4 leaf stage. Seedling or rosette stage for bluebur, kochia, flixweed, hawk's-beard, shepherd's-purse, stinkweed. Green foxtail - when the majority of plants are in the 3 leaf stage (less than 2.5 cm tall), effectiveness declines rapidly after the 5th leaf. Under dry conditions (soil moisture deeper than 5 cm) apply when green foxtail is in the 2-3 leaf stage. ***Crops:*** Glean Mix - Cereals 2-4 leaf stage. MCPA Mix - Cereals 2-5 leaf stage only; Flax between 5-12.5 cm tall. 2,4-D Mix - Wheat 3-5 leaf stage only. ***Temperature Effects:*** Do not spray flax when temperatures exceed 30°C. Best weed control when relative humidity is high and daily maximum temperatures exceed 21°C. Under hot, dry and low relative humidity conditions spray during early morning or evening. Avoid spraying if crop is recovering from frost damage or if frost is expected within 24 hours.

7. HOW TO APPLY:
With: Ground equipment only. Spra-coupe not recommended.
Rate: ***Stampede 360:*** 1.1 L/ac (cereals, flax). ***Glean:*** 6-12 g/ac [barley (only Argyle, Bedford, Klages), wheat (durum, spring)]. ***MCPA Ester 500:*** 220 mL/ac (cereals, flax). ***2,4-D Amine 500:*** 485 mL/ac [wheat (durum, spring)]. ***2,4-D Esters:*** Durum wheat - Ester 500=325 mL/ac, Ester 600=270 mL/ac, Ester 700=230 mL/ac. Spring wheat - Ester 500=325-485 mL/ac, Ester 600=270-400 mL/ac, Ester 700=230-345 mL/ac.
Water Volume: Field sprayers - 40 L/ac. Floater type equipment - 60 L/ac
Pressure: 275 kPa
Ground Speed: 8 km/h for field sprayers, 20 km/h or less for floaters.
Nozzles: Only flat fan nozzles. Flooding nozzles can be used on floaters.

8. APPLICATION TIPS: • Drain and flush sprayer tank and lines after spraying is completed. • Do not apply Stampede 360 in fields to which Atrazine has been applied during the previous 2 years. • A 3 day interval is required before or after an application of Stampede 360 and another herbicide. • ***Insecticide Intervals:*** Severe injury of crops may result from a tank mix or separate applications of Stampede 360 and certain insecticides in the same crop year e.g. Sevin (carbaryl), parathion methyl, or Guthion. Decis may be applied any time before or after Stampede 360 or tank mixed with Stampede 360. After applying Stampede 360, wait a minimum of 5 days for wheat and 10 days for barley before applying Furadan. After applying Stampede 360, wait a minimum of 14 days before applying dimethoate (Cygon) or Malathion. No other insecticides are registered for foliar use in the same year as Stampede 360. Do not spray with Stampede 360 if the field was treated with soil-applied systemic organophosphorous insecticides in the same or previous crop year.

9. HOW IT WORKS: Absorbed by leaves and causes cell wall breakdown and interference with the cellular metabolism. Activity is primarily contact, therefore, thorough spray coverage is necessary for optimum weed control. Susceptible weeds become tolerant beyond the 4 leaf stage. Stress conditions will trigger a hardening off process and hasten the development of tolerance to chemical control.

10. EXPECTED RESULTS: ***Weeds:*** Affected weeds turn brown in 3-5 days and have a "burnt-off", or desiccated, appearance. Weeds past the recommended stage will show extensive browning, but some degree of green, tissue remains. New tissue is produced, and the weed will recover. Weeds emerging after spraying are unaffected. ***Crops:*** Temporary yellowing and leaf tip burn occur and is more pronounced in oats, flax and barley than in wheat. Effects will disappear 10-14 days after treatment. New growth is not affected and yields are not reduced. Under stress conditions, a slight delay in crop maturity may be noticed.

11. EFFECTS OF RAINFALL: Light rainfall 1 hour after application will not affect performance.

12. MOVEMENT IN SOIL: Not applicable

13. GRAZING AND CROPPING RESTRICTIONS: None.

14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = Stampede 360 (3130), technical (560). Propanil has potential to cause chlorachne - a skin disease in man following long-term exposure.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to reduce skin exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). ***Symptoms of poisoning:*** giddiness, intoxication and headache. IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Heated storage not required. If frozen, warm and agitate thoroughly to redissolve crystals.

SUTAN$^+$ (butylate)

Chipman

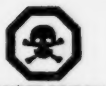
1. FORMULATIONS: Emulsifiable Concentrate; 800 g/L; 20 L container.
2. REGISTERED MIXES: Atrazine, Bladex, dry and liquid fertilizers (urea and urea blends only). ***Mix Restrictions:*** Check compatibility.
3. CROPS: Corn (field, silage, sweet).
4. WEEDS CONTROLLED:

SUTAN$^+$	**SUTAN$^+$ + Atrazine**	**SUTAN$^+$ + Bladex**
grass, barnyard	buckwheat, wild	buckwheat, wild
foxtail (green, yellow)	lady's-thumb	lady's-thumb
panicum, fall	lamb's-quarters	lamb's-quarters
	mustards	mustards
	oats, wild	nightshade, black
	pigweed, redroot	purslane
	purslane	ragweed
	ragweed	shepherd's-purse
	smartweed	

5. WEEDS SUPPRESSED: None.
6. WHEN USED: Pre-plant soil incorporated.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 1.7-2.2 L/ac. Sandy soils 1.7 L/ac. Clay soils 2.2 L/ac. Atrazine Mix: 1.7-2.2 L/ac SUTAN$^+$ + 0.6-0.9 kg/ac Atrazine 80 W or 0.93-1.45 L/ac Atrazine L. Bladex Mix (80 W or Liquid): 1.7-2.2 L/ac SUTAN$^+$ + 0.9-1.1 kg/ac Bladex 80 W or 1.5-1.9 L/ac Bladex Liquid.
   Water Volume: 40 L/ac minimum.
   Incorporation: Within minutes of application. Use power driven cultivation equipment, set to cut 5-7.5 cm deep or disc set 10-15 cm. Both types of equipment should operate at 6.9-9.5 km/h . Light duty cultivators with tines on 15-20 cm centres, set 10 cm deep and operate at 9.5-13 km/h. For discs and field cultivators, a second working at right angles to the first will ensure thorough mixing.
   Pressure: 275 kPa.
8. APPLICATION TIPS: Proper rates, immediate double incorporation (within 1 hour) is very important.
9. HOW IT WORKS: Absorbed by roots and shoots of a germinating weed, disrupts and stops growth causing eventual death of germinating weed.
10. EXPECTED RESULTS: ***Weeds:*** Affected weeds do not emerge, distorted and chlorotic shoots are visible by removing the top layer of treated soil. ***Crops:*** SUTAN$^+$ is safe on crop. Other chemicals, insects, or weather may weaken seedlings resulting in crop injury. ***Poor results may be expected if:*** soils are wet, cloddy and trashy, these soil conditions are not suitable for proper application and incorporation.
11. EFFECTS OF RAINFALL: Soluble in water therefore, excessive moisture may cause some leaching.
12. MOVEMENT IN SOIL: Will not move readily.
13. GRAZING AND CROPPING RESTRICTIONS: No restrictions on grazing, crop use after hail, or succeeding crops. Danger from drift is low.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (3,690-4,500).
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention. Get medical attention immediately.
16. STORAGE: Heated storage not required.

SWEEP (paraquat)

Chipman



1. FORMULATIONS: Liquid; 250 g/L; 20 L container.
2. REGISTERED MIXES: bromoxynil + MCPA; dicamba + 2,4-D; linuron + MCPA; 2,4-D; MCPA.
   Mix Restrictions: Use very clean water as muddy water will inactivate chemical. Use amine formulations immediately.
   Mixing with other pesticides: Not applicable.
3. CROPS: Summerfallow ***Underseeding:*** Not applicable
4. WEEDS CONTROLLED: Annual grasses and annual broad-leaf weeds when tank-mixed with broad-leaf herbicide.
5. WEEDS SUPPRESSED: Most perennial weeds
6. WHEN USED: At the 2-4 leaf stage of annual weeds.
7. HOW TO APPLY:
   With: Ground equipment. Do not use mist blowers.
   Rate: 910 mL/ac for annual grass control.
   Water Volume: 50-80 L/ac weeds in 2-4 leaf; 60-80 L/ac weeds in advanced stage. Higher volumes when foliage is dense.
   Pressure: 300 kPa
8. APPLICATION TIPS: • Thorough coverage of weeds is essential. • Apply Sweep + linuron + MCPA mix only once per year in spring. • Applications made on cloudy days, or periods of darkness will generally increase the effectiveness. • Thoroughly wash equipment after spraying using Agral 90 at 60 mL/100 L of water.
9. HOW IT WORKS: A contact herbicide absorbed by leaves and stems. Interferes with photosynthesis and causes yellowing and eventual death.
10. EXPECTED RESULTS: ***Weeds:*** provides immediate, fast and virtually complete annual grass control. Repeat applications will be necessary when new weeds emerge. Yellowing occurs in a few hours, followed by rapid desiccation and later death. When tank-mixed with a broad-leaf herbicide, most annual weeds will be controlled. ***Crop:*** Not applicable.
11. EFFECTS OF RAINFALL: No effect once the spray solution has dried on the plant.
12. MOVEMENT IN SOIL: None.
13. GRAZING AND CROPPING RESTRICTIONS: None. Avoid drift onto crops, grazing areas, and other desirable growth.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (120). **May be fatal if swallowed.**
15. PRECAUTIONS; FIRST AID: Wear standard protective clothing (see page 4) plus a pesticide respirator and rubber gloves to avoid skin and lung exposure. KEEP OUT OF REACH OF CHILDREN AND ANIMALS. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately.
16. STORAGE: Never transfer to other containers. Store tightly in original containers and in a safe place. Heated storage.

TARGET (MCPA + mecoprop + dicamba)

Ciba-Geigy

CAUTION POISON

1. FORMULATIONS: Liquid; 275 g/L MCPA + 62.5 g/L mecoprop + 62.5 g/L dicamba; 2 X 10 L pack.
2. REGISTERED MIXES: Afolan F, Lorox L, Sencor, liquid nitrogen fertilizer (28-0-0)(winter wheat only).
3. CROPS: Annual canary grass (8.5), barley (8.5), oats (9.0), summerfallow (thistle control), wheat [durum and hard red spring (8.4), winter (8.5)].
4. WEEDS CONTROLLED:

buckwheat (Tartary, volunteer, wild)(8.0)	hemp-nettle (7.0)	mustards (ball, volunteer, wild, wormseed)(8.8)	smartweeds, annual (8.0)
catchfly, night-flowering (7.5)	knotweed	pigweed (prostrate, redroot)(8.8)	sow-thistle, annual
cleavers (7.5)	kochia (8.0)	ragweed, common	spurry, corn (8.8)
cockle, cow (8.5)	lady's-thumb	rapeseed, volunteer (8.5)	stinkweed (8.4)
flixweed	lamb's-quarters (8.7)	shepherd's-purse	sunflowers, volunteer (8.0)
			thistle, Russian (8.5)

5. WEEDS SUPPRESSED: Canada thistle, bindweed (field and hedge).
6. WHEN USED: Annual canary grass, wheat (durum, spring), oats, - 2-5 leaf stage. Barley - 2-3 leaf stage. Summerfallow - thistles are in the early bud stage. Weed growth stage - 2-5 leaf stage. Winter wheat - apply in spring before crop is more than 30 cm tall. **NOTE:** Treatment at other than recommended crop stage may cause injury.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 405-610 mL/ac. Cleavers (1-2 whorl stage) - 610 mL/ac. Thistle control on summerfallow 810 mL/ac in 1st year; 405-610 mL/ac in 2nd year.
   Water Volume: 40 L/ac. When using 28-0-0 liquid nitrogen as carrier, use 45 L/ac of total solution.
   Pressure: 200-300 kPa
8. APPLICATION TIPS: • For hemp-nettle control, apply before the second pair of true leaves appear.
   • Use the higher rate when weeds are beyond the 3 leaf stage, when weed densities are high or under adverse weather conditions.
   • In winter wheat, spray winter annuals as soon as growth begins in spring or if 28-0-0 liquid nitrogen is used as the carrier.
   • Do not let contents stand for long periods of time without agitation.
9. HOW IT WORKS: A combination of 3 systemic hormonal herbicides which accummulate in the growing point of susceptible plants, produce abnormal growth and disrupt the transport system in plants.
10. EXPECTED RESULTS: ***Weeds:*** Visible effects occur 7-14 days after treatment. Leaves curl, leaf edges turn brown, petioles twist, plant ceases growth and turns brown and dies. ***Crop:*** Improper or untimely application can result in abnormal bending at the nodes of grain stalks, difficulty in head emergence from sheath, curled awns, malformed kernels and sterile florets. Under certain conditions straw shortening may occur but yield will not be affected. ***Poor results may be expected if:*** there is poor coverage, rainfall less than 3 hours after application or weeds too advanced. Dicamba containing products can be hard on crops if incorrectly applied.
11. EFFECTS OF RAINFALL: Rainfall within 3 hours will reduce activity.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: None. ***Drift:*** Most vegetables and fruit crops are very sensitive.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,028). **Long-term continuous exposure to this product may produce enlarged kidneys.** Non-toxic to fish. Toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Heated storage only.

TORCH DS (bromoxynil)
Union Carbide

1. FORMULATIONS: Emulsifiable Concentrate; 450 g/L; 10 L jug.

2. REGISTERED MIXES: Atrazine; Avenge; Avenge+MCPA ester; Glean (6 g/ac only; barley, spring wheat); Hoe-Grass 284; MCPA (amine, ester, Estemine, K-Salt); Roundup; 2,4-D (amine, ester, Estemine). Reduced rate Torch DS+2,4-D ester; registered for select weed control (see Weeds Controlled). ***Mixing Restrictions:*** Add Atrazine; MCPA; or 2,4-D to water first, then add Torch DS.

3. CROPS:

barley (9.0)
canary grass (9.0)
corn, field (9.0)
corn, sweet (7.9)
flax (8.6)
oats
rye, fall
triticale (8.9)
wheat [durum (8.9), spring (8.9), winter]
zero till (Roundup tank mix)

Seedling grasses for seed production
bromegrass
fescue [creeping red, meadow (8.3)]
orchard grass (8.9)
reed canary grass
wild rye, Russian (9.0)
timothy
wheatgrass (crested, intermediate, slender, tall)(8.5)

Underseeding: legumes not recommended

4. WEEDS CONTROLLED:

buckwheat (Tartary, wild)(8.4)*
catchfly, night-flowering (7.6)
chamomile, scentless
cockle, cow (7.9)
groundsel, common (9.0)
knawel (7.7)
kochia (8.2)*
lady's-thumb
lamb's-quarters (8.4)*
mustard, wild (8.5)*
nightshade (American, black)
pigweed, redroot (7.9)
ragweed, common
smartweeds, annual (8.1)*
stinkweed (8.4)*
thistle, Russian (8.4)*

*=Weeds controlled by reduced rate of Torch DS+2,4-D ester.

5. WEEDS SUPPRESSED: None

6. WHEN USED: ***Weeds:*** Seedling to 4 leaf stage except Russian thistle to 5 cm tall. Generally best results if weeds are in seedling stage. To control scentless chamomile and knawel, spray before 3 leaf stage. ***Crops:*** Barley, canary grass, corn (field, sweet), oats, triticale, wheat - 2 leaf to early flag leaf. 2,4-D Mix on wheat or barley after 4 leaf. Winter wheat, fall rye - first growth to early flag leaf. Corn - alone or Atrazine Mix - until crop is 25 cm tall. Flax 5-10 cm tall. Canary grass - 3-5 leaf. Seedling grasses, grown for seed production - 2-4 leaf.

7. HOW TO APPLY: Ground equipment. Spra-coupes - not recommended.

Rate:

Crop	Torch DS
Barley, canary grass, corn (field, sweet), oats, triticale, wheat.	250-300 mL/ac
Flax	250 mL/ac
Rye (fall), wheat (winter)	300 mL/ac
Seedling grasses (grown for seed production)	350 mL/ac

	Torch DS	+	Hoe-Grass 284
Broadleaf weeds and wild oats (1-4 leaf)	250 mL/ac		1.0 L/ac

	Torch DS	+	2,4-D Ester LV500	2,4-D Ester LV600	2,4-D Ester LV700
Barley, wheat (reduced Torch DS rate).	166 mL/ac		344 mL/ac OR	287 mL/ac OR	247 mL/ac

Water Volume: 40 L/ac. Corn - 60 L/ac.
Pressure: 275 kPa
Nozzles: Flat fan nozzles recommended.

8. APPLICATION TIPS: • Avoid spraying crops during adverse growing conditions especially drought, high temperatures (over 29°C) or in high humidity.

9. HOW IT WORKS: A contact herbicide so good coverage is essential. Inhibits respiration and photosynthesis causing death.

10. EXPECTED RESULTS: ***Weeds:*** turn brown and die within 3-5 days - more rapid under good growing conditions and when applied to seedling weeds. ***Poor results can be expected if:*** weeds past 4 leaf stage, poor spray coverage or, lower than recommended rate used. Injury to corn or flax may occur if under stress.

11. EFFECTS OF RAINFALL: None.

12. MOVEMENT IN SOIL: None.

13. GRAZING AND CROPPING RESTRICTIONS: None.

14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (115). Very toxic to fish, snails and slugs.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) when applying. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). ***Symptoms of acute poisoning:*** stomach cramps, diarrhea, sore throat may appear. IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Does not require heated storage.
NOTE: A similar product, Pardner, is listed on page 74.

TORDON 10K PELLETS, TORDON 22K (picloram)(Industrial)
TORDON 101 MIXTURE (picloram + 2,4-D)(Industrial)

Dow

Available only to authorized pesticide applicators.

1. FORMULATIONS: Pellets; Tordon 10K pellets; 10%; 25 kg bag. Solution - Tordon 22K; 240 g/L; 2 L bottle, 18.9 L pail. - Tordon 101 Mixture; 60 g + 240 g/L; 18.9 L, 205 L containers.
2. REGISTERED MIXES: None.
3. CROPS: **10K** - non-crop areas (utility rights-of-way, military bases, pipelines, firebreaks). **22K** - permanent grass pastures, rangeland, spot treatment on cultivated cropland, utility rights-of-way. **101 Mixture** - non-crop areas (utility rights-of-way).
4. WEEDS CONTROLLED: **10K** - ***Group 1:*** Basswood, birch, cedar, pincherry, poplar, wild rose, willow and other susceptible species. ***Group 2:*** Alder, fir, maple, pine, spruce. ***Group 3:*** Oak, tamarack. **22K** - ***Group 1:*** Scentless chamomile. ***Group 2:*** Knapweed (diffuse, spotted). ***Group 3:*** Canada thistle, pasture sage, poverty weed, Russian knapweed, sow-thistle. ***Group 4:*** Field bindweed, leafy spurge, toadflax. **101 Mixture** - ***Brush:*** Alder, birch, cedar, maple, pine, poplar, spruce, and other species. ***Weeds:*** Burdock, Canada thistle, clover (red, sweet), common ragweed, dandelion, dock, goldenrod, fleabane, plantain, prickly lettuce, vetch, wild carrot.
5. WEEDS SUPPRESSED: None.
6. WHEN USED: **10K** - spring or early summer before growth begins or during vigorous growth and when abundant moisture can be expected. **22K** - anytime when fully developed green leaves are present. ***101 Mixture*** - ***Brush:*** after foliage is well developed. Unsatisfactory results may occur if applications are made when foliage has lost its normal green colour. ***Weeds:*** spring or early summer after growth appears.
7. HOW TO APPLY:
   With: ***10K*** - Cyclone spreader, ground operated granular air spreader. ***22K*** - Boom or hand gun. ***101 Mixture*** - Ground equipment or helicopter using drift control agent.
   Rate: 10K Pellets - ***Group 1 (see Weeds Controlled):*** 16-20 kg/ac. ***Group 2:*** 20-24 kg/ac. ***Group 3:*** 38 kg/ac. **22K** - ***Group 1:*** 445 mL/ac. ***Group 2:*** 910 mL/ac. ***Group 3:*** 1.8 L/ac. ***Group 4:*** 3.6 L/ac. **101 Mixture** - ***Brush:*** 7.3-10 L/ac. ***Weeds:*** 2.8 L/ac.
   Water Volume: 22K - 160-324 L/ac. **101 Mixture** - 80 L/ac.
8. APPLICATION TIPS: • Spread Tordon 10K Pellets evenly over the ground surface above tree roots. Higher rates may cause grass injury in drier areas of the province. • Tordon 22K used as a spot treatment in a crop. No spot treatment should exceed 1 acre, and the total area treated in any 1 field in a year should not exceed 5% of the total acreage. **NOTE:** Picloram is extremely persistent and water soluble. Small quantities may cause damage to desirable plants. Do not apply, or permit any Tordon to contaminate soil used to grow desirable susceptible plants. Do not contaminate water used for irrigation or domestic purposes.
9. HOW IT WORKS: Interferes with cell division, causing leaf cupping, stem distortion and eventual death of plant. Tordon 10K pellets require moisture to carry picloram to the roots. Tordon 101 and 22K are absorbed through leaves and roots.
10. EXPECTED RESULTS: **10K and 101 Mixture:** 2-3 weeks after the first rainfall after treatment, leaves of affected trees become dull and cupped; orange streaks appear on stems of poplar trees, leaves become brown and brittle, as the tree dies. **22K:** Perennial weeds show distorted stems and cupped leaves, which turn yellow and then brown. Usually native grass increases in abundance as a result of reduced competition. ***Poor results may be expected if:*** there is heavy rainfall immediately after treatment on light sandy soil.
11. EFFECTS OF RAINFALL: Heavy rainfall may dissolve and carry picloram away from the target area, or percolate dissolved picloram out of the root zone of target plants.
12. MOVEMENT IN SOIL: Picloram is very soluble in water and moves readily with water.
13. GRAZING AND CROPPING RESTRICTIONS: Do not graze treated area by dairy animals within 6 weeks after treatment. Manure from picloram treated vegetation should not be used to grow sensitive crops but rather be returned to a cereal crop field. When applied as a spot treatment on cropland, picloram may persist in soil for up to 5 years, and prevent the establishment of sensitive crops. ***Succeeding Crops:*** **First Year:** Oats. **Second Year:** Oats or barley. **Third Year:** Oats, barley or wheat. A reduction in yield in the first year, is usually offset by benefits of weed control obtained. Legumes may not be established in a pasture for several years after a Tordon treatment. If legumes are essential in a pasture, do not use Tordon.
14. TOXICITY: Low (10K, 22K) or moderate (101 Mixture) acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = Technical Picloram (8,200); Tordon 10K Pellets (5,000); Tordon 22K (10,330); Tordon 101 Mixture (3,080).
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6).
16. STORAGE: Tordon 10K Pellets: Store in a cool, dry place. Tordon 22K and Tordon 101 Mixture: Store in a cool, dry place. Do not freeze. If freezing occurs, bring to room temperature and mix thoroughly.

TORDON 202C (picloram + 2,4-D)

Dow

1. FORMULATIONS: Liquid; 12 g/L picloram + 200 g/L 2,4-D; 20 L pail.
2. REGISTERED MIXES: None
3. CROPS: Barley (8.7), wheat (7.7)(all types). ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED:

buckwheat, Tartary (4.7)	dandelion (seedlings)	pigweed, redroot (1)	thistle, Russian
buckwheat, wild (7.2)	lamb's-quarters	smartweed, green (3.9)	
cocklebur	mustard, wild (8.6)	stinkweed (seedlings)	

5. WEEDS SUPPRESSED: Canada thistle, perennial sow-thistle.
6. WHEN USED: 3-5 leaf stage of crop. Seedling (2-4 leaf) stage of weeds.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 610-810 mL/ac
   Water Volume: 40-80 L/ac
   Pressure: 200-275 kPa
8. APPLICATION TIPS: • Treat during warm weather when the weeds are young and growing actively. • Use the maximum rates when slow growth conditions prevail or heavy infestations occur. • Do not apply to areas where surface water can run off to adjacent cropland or into bodies of water.
9. HOW IT WORKS: Absorbed by leaf, stem and roots and translocated throughout the plant to the growing points. Residue in soil controls some late germinating weeds.
10. EXPECTED RESULTS: Death of weeds is not immediate but growth is slowed and eventually ceases. Under dry conditions straw shortening in wheat may occur, but yield will not be affected.
11. EFFECTS OF RAINFALL: Rainfall within 4-6 hours of application may reduce activity.
12. MOVEMENT IN SOIL: Picloram degrades very slowly in soil and water, and may be leached out, after rainfall, from soils low in organic matter.
13. GRAZING AND CROPPING RESTRICTIONS: Do not permit meat animals being finished for slaughter nor dairy animals to forage or graze treated fields within 2 weeks of treatment. ***Drift:*** Small amounts can damage many desirable broad-leaf plants. ***Use of Straw from Treated Fields:*** Do not use straw from treated crops for composting or mulching on susceptible broad-leaf crops. If straw is used for bedding or animal feed return the manure to fields to be planted to grain crops, flax or rapeseed. ***Rotational crops:*** Fields previously treated with Tordon 202C may be seeded to rapeseed (including canola), mustard, flax, wheat, oats, barley or summerfallow. ***Succeeding crops:*** Certain desirable broadleaf crops can be damaged by small amounts of Tordon 202C in the soil. Alfalfa and sunflower should not be planted until at least 3 years after treatment; beans, lentils, peas and potatoes after 5 years. ***Handling Treated Soils:*** Treated soil should not be moved to other areas, nor used to grow susceptible broad-leaf plants unless an adequately sensitive bioassay or chemical test shows that no detectable picloram is present.
14. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (1500-2500). May cause eye irritation. Non-toxic to fish and bees. There is no dioxin in the 2,4-D of this formulation.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Heated storage. If freezing occurs, warm and mix thoroughly before using.

TREFLAN (trifluralin)
Elanco
(Cereals)

1. FORMULATIONS: Emulsifiable Concentrate; Treflan 545 EC; 545 g/L; 8.5 L jug. Granular; Treflan QR5; 5%; 25 kg bag.
2. REGISTERED MIXES: Avadex BW, liquid fertilizer, Avadex BW+liquid fertilizer. ***Mix Restrictions:*** Add Treflan or Treflan+Avadex directly into the liquid fertilizer, mix thoroughly and apply as soon as possible. Agitate until application is complete.
3. CROPS: ***Treflan 545 EC:*** Barley, wheat (durum, spring). ***Treflan QR5:*** Barley only. ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED: Green and yellow foxtail.
5. WEEDS SUPPRESSED: None
6. WHEN USED: ***Treflan 545 EC:*** Alone or with Avadex BW in the spring only after seeding and prior to emergence of crop. *Treflan QR5:* Fall only.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 445 mL/ac on light to medium textured soil. 610 mL/ac on heavy textured soil.
   Water Volume: 40 L/ac
   Incorporation: Incorporate 2-4 cm with two cross harrowings with tyne or diamond harrows operated at a minimum of 9 km/h. Both incorporations must be done within 24 hours of application.
   Pressure: 275 kPa
8. APPLICATION TIPS: • Apply only on fields that are trash free or summerfallow fields. • Crop must be seeded 5-8 cm deep in a well tilled seedbed to prevent contact between the chemical and the seed.
9. HOW IT WORKS: Acts on both the root and shoot tips as they emerge. Prevents cell division and affected plants die before emergence. If the shoot portion of the plant escapes to the soil surface, lateral or secondary root growth is inhibited causing a slow death since the plant is unable to gather moisture or nutrients.
10. EXPECTED RESULTS: ***Green Foxtail:*** Seeds germinating in the treated layer die before reaching the soil surface because root and shoot growth are inhibited. Seeds germinating below the treated layer will produce plants that will emerge. The secondary root system of plants that form within the treated layer is completely inhibited by trifluralin present in that area. The affected plant dies slowly as crop competition and temperature stress over-tax the rootless plant's ability to take up moisture. ***Crop:*** Injury is minimized when seeded to a depth of 5-8 cm. Seedling disease, cold weather, improper seeding depth, Excessive moisture, high salt concentration, or drought may weaken crop seedlings and increase the possibility of damage from Treflan.
11. EFFECTS OF RAINFALL: No effect once incorporated into the soil.
12. MOVEMENT IN SOIL: None.
13. GRAZING AND CROPPING RESTRICTIONS: Under normal conditions, Treflan carryover will not harm crops grown in rotation. As a precaution; oats, sugar beets, and small-seeded annual grasses such as timothy, canary seed grass, and creeping red fescue should not be grown following a Treflan treated crop.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (10,000). In clean water, fish are very sensitive to trifluralin; but in runoff and muddy water, trifluralin binds to the suspended soil particles and large amounts can be tolerated by fish. Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Do not store below 5°C. If stored below 5°C, bring contents to 15°C for 24 hours and shake well before using.

***SPECIAL USE: Treflan QR5 on barley ONLY - Fall application ONLY.**
Weeds Controlled/Application Tips: See QR5 under Treflan (oilseed).
When Used: Fall application only. September 1 to freeze up.
How to Apply: See QR5 under Treflan (oilseed).
Rate: Sandy textured, brown and dark brown soil (2-4% O.M.): 6.9 kg/ac. Medium or heavy textured, brown and dark brown soils (2-4% O.M.): 8.9 kg/ac. Sandy textured, black soils (4-6% O.M.): 8.9 kg/ac. Medium or heavy textured, black soils (4-6% O.M.): 11.3 kg/ac. **Warning:** Do not apply on soils containing less than 2% organic matter or on deep black soil containing more than 6% organic matter. Application to severely eroded knolls may result in reduced crop stand. Do not apply on land treated with Treflan since June 1 of the previous year. Using press or hoe drill, seed 5 cm deep into a moist, warm seedbed. Avoid seeding into very cold soil.
NOTE: Similar products, Rival and Triflurex, are listed respectively on pages 81 and 103.

TREFLAN (trifluralin)

Elanco

(Oilseeds, Special Crops)

1. FORMULATIONS: Emulsifiable Concentrate; Treflan 545 EC; 545 g/L; 8.5 L jug. Granular; Treflan QR5; 5%; 25 kg bag.

2. REGISTERED MIXES: Treflan 545 EC - Amiben (soybean, sunflowers); Sencor 500 F or 75 DF [canola (triazine tolerant canola), fababeans]. Liquid nitrogen fertilizer (28-0-0). ***Mix Instructions:*** Pour directly into liquid fertilizer, mix thoroughly and apply as soon as possible with constant agitation.

3. CROPS:

beans (black, lima)	crambe	mustard (9.0)	soybeans (8.8)
beans, dry (kidney, white)(8.0)	fababeans (8.6)	peas (8.7)(field, canning)	sunflowers (9.0)
canola (including	flax*(7.7)	shelterbelts**	
triazine tolerant)(8.8)	lentils*(8.7)		

* Fall application only. ***Underseeding:*** Not recommended.

** Shelterbelts - ash (green), caragana, elm (American, Siberian), pine (Scotch).

4. WEEDS CONTROLLED:

bluegrass, annual	chickweed (7.1)	grass, barnyard (8.3)	pigweed (8.2)
brome, downy	cockle, cow (9.0)	knotweed	purslane
bromegrass	darnel, Persian	lamb's-quarters (8.0)	thistle, Russian (7.9)
buckwheat, wild (8.3)	foxtail (green, yellow)(8.1)	oats, wild (7.5)	

5. WEEDS SUPPRESSED: None.

6. WHEN USED: ***Spring:*** Treflan 545 EC only. cultivate to destroy existing weeds and apply immediately prior, to or up to 3 weeks before planting.
Fall: September 1st to freeze-up. **Fall incorporation is discouraged where soil drifting is a problem.**
Summer: On summerfallow between June 1st to September 1st. Second incorporation and subsequent incorporations may be done anytime prior to soil freeze-up.
Special Instructions for Flax, Lentils: Not recommended for spring application. Both incorporations of Treflan 545 EC or QR5 must be done in the fall. Shallowly till and pack the soil in the spring to ensure a firm seedbed and an accurate depth for seeding. Seed no more than 4 cm deep.

7. HOW TO APPLY:
With: Ground equipment only.
Rate: ***Spring*** - 545 EC only. 610 mL/ac on sandy soils with 2-6% organic matter. • 810 mL/ac on all medium and heavy textured soils up to 15% organic matter and on sandy soils with greater than 6 but less than 15% organic matter. • 1050 mL/ac on medium and heavy textured soils with 6-15% organic matter and high wild oat pressure.
Fall - 810 mL/ac 545 EC, 8.9 kg/ac QR5 on sandy soils with 2-6% organic matter. • 1050 mL/ac 545 EC, 11.3 kg/ac QR5 on all medium or heavy textured soils up to 15% organic matter and for sandy soils with greater than 6% but less than 15% organic matter. • 1.2 L/ac 545 EC, 13.7 kg/ac QR5 on medium and heavy textured soils with 6-15% organic matter and high wild oat pressure.
Summer - 1.2 L/ac 545 EC, 13.7 kg/ac QR5.
Shelterbelts - sandy, sandy loam soils 1.65 L/ac 545 EC. Medium and heavy textured soils 3.3 L/ac 545 EC.
Triazine Tolerant Canola - See Sencor for rates as a tank mix. Treflan 545 EC and QR5 may be applied alone on triazine tolerant canola. Sencor or Bladex TTC may then be applied as a sequential treatment after crop emergence to control several additional weeds.
Water Volume: 40 L/ac
Incorporation: First incorporation must be done within 24 hours of application. Second incorporation should be done at right angles to the first. A tandem disc, discer or field (vibra shank) cultivator are recommended for incorporating to 8-10 cm. Operate discers at 8-10 km/h and cultivator at 10-13 km/h.
Pressure: 275 kPa

8. APPLICATION TIPS: • Do not apply Treflan 545 EC to soils with more than 20-25% straw cover or on standing weeds. On stubble, chop and thoroughly mix residues into the soil prior to addition of Treflan EC. • Treflan QR5 can be used when trash is heavier or on standing weeds, provided they do not interfere with the distribution of the granule and do not limit incorporation. Delay second incorporation of QR5 for 3 days. This allows time for greater release of QR5 into the soil and assures a more uniform distribution. • Do not apply on soils that are wet, in poor tilth, or contain 15% or more organic matter. • Overapplication caused by overlapping or improper calibration or non-uniform application may reduce the stand of crop grown in rotation. • A tandem disc gives the best mixing action on stubble conditions. Do not use a field cultivator to incorporate Treflan when soil is crusted, lumpy or too wet for good mixing. • When fall application is used, it is preferred that both incorporations be completed in the fall. • Fall or summer application should be followed by a light spring tillage to a 5-8 cm deep before seeding. • To avoid concentrating wild oat seeds below the treated layer, do not plow land prior to Treflan application.

9. HOW IT WORKS: Kills seedlings as they germinate. Inhibits cell division in the actively growing points of root and shoot.

10. EXPECTED RESULTS: ***Weeds:*** Most die before emerging. Weeds will exhibit swelling in the coleoptile region, stubby, thick primary root development and lack of secondary roots, which leads to death due to inadequate moisture obtaining ability. ***Crop:*** seed flax into a well packed warm moist seedbed. Do not seed deeper than 4 cm.

11. EFFECTS OF RAINFALL: No effect once Treflan is incorporated into the soil.

12. MOVEMENT IN SOIL: None.

13. GRAZING AND CROPPING RESTRICTIONS: None. ***Crop Use After Hail:*** No restrictions ***Succeeding Crops:*** Normally, Treflan carry over will not harm crops grown in rotation. As a precaution, oats, sugar beets and small seeded annual grasses should not be grown in rotation following a Treflan treated crop. Drought conditions in the year of treatment may result in higher levels of trifluralin carry-over into the next year, to avoid wheat injury, seed less than 7 cm deep into a warm moist seedbed.

14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (10,000). In clean water, fish are very sensitive to trifluralin, but in run off or muddy water, it binds to soil particles and large amounts can be tolerated by fish. Non-toxic to bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.

16. STORAGE: Do not store below 5°C. If stored below 5°C, bring the contents to 15°C for 24 hours and shake well before using. Do not store near heat, spark or open flame.
NOTE: Similar products, Rival and Triflurex, are listed respectively on pages 82 and 104.

Triflurex (trifluralin)
Makhteshim–Agan
(Cereals)

1. FORMULATIONS: Emulsifiable Concentrate; 400 g/L; 22.7 L containers.
2. REGISTERED MIXES: Avadex BW, Avadex BW + liquid nitrogen fertilizer (28-0-0), liquid nitrogen fertilizer (28-0-0).
   Mix Restrictions: Add Triflurex or Triflurex + Avadex directly into the liquid fertilizer, mix thoroughly and apply as soon as possible. Agitate until application is complete.
3. CROPS: Barley, wheat (durum, spring). ***Underseeding:*** Not recommended.
4. WEEDS CONTROLLED: Green foxtail.
5. WEEDS SUPPRESSED: None
6. WHEN USED: Apply alone or as a tank mix with Avadex BW in the spring after seeding and prior to emergence of wheat or barley.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: Sandy to loamy soils - 565 mL/ac. Clay type soils - 850 mL/ac.
   Water Volume: 40 L/ac
   Incorporation: Incorporate 2-4 cm with 2 cross harrowings with tyne or diamond harrows operated at a speed of at least 8 km/h. Where possible spray and incorporate in the same operation. Incorporate twice within 8 hours.
   Pressure: 275 kPa
8. APPLICATION TIPS: • Apply only on fields that are trash free or summerfallow. • Apply only to soils with less than 15% organic matter which are dry and in good working condition. Do not treat soils that have the potential of becoming water-logged. • Crop must be seeded 5-8 cm deep in a well tilled seedbed to prevent contact between the chemical and the seed.
9. HOW IT WORKS: Acts on both the root and shoot tips as they emerge. Prevents cell division and affected plants die before emergence. If the shoot portion of the plant escapes to the soil surface, lateral or secondary root growth is inhibited causing a slow death since the plant is unable to gather moisture or nutrients.
10. EXPECTED RESULTS: ***Green Foxtail:*** Seeds that germinate below the treated layer will produce plants that will emerge. The secondary root system of plants that form within the treated layer is completely inhibited by trifluralin present in that area. The affected plant dies slowly as crop competition and temperature stress over-tax the rootless plant's ability to take up moisture. ***Crop:*** injury is minimized when seeded to a depth of 5-8 cm. ***Poor results may be expected if:*** Conditions causing seedling stress, such as wet soils, incorrect planting depth, seedling disease, low temperatures, excessive salt in soil, or drought could bring about damage to the crop.
11. EFFECTS OF RAINFALL: No effect once incorporated into the soil.
12. MOVEMENT IN SOIL: None.
13. GRAZING AND CROPPING RESTRICTIONS: None. ***Succeeding Crops:*** Under normal conditions there will not be a carryover. As a precaution, creeping red fescue, oats, small seeded annual grasses such as canary seed grass, sugar beets, or timothy grass should not be grown in rotation following a trifluralin treated crop.
14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (10,000). In clean water, fish are very sensitive to trifluralin; but in runoff and muddy water, trifluralin binds to the suspended soil particles and large amounts can be tolerated by fish. Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.
16. STORAGE: Do not store below 5°C. If stored below 5°C, bring the contents to 15°C for 24 hours and shake well before using. Do not store near heat, spark or open flame.
    NOTE: Similar products, Rival and Treflan, are listed respectively on pages 81 and 100.

Triflurex (trifluralin)
Makhteshim–Agan
(Oilseeds, Special Crops)

1. FORMULATIONS: Emulsifiable Concentrate; 400 g/L; 22.7 L containers.

2. REGISTERED MIXES: Liquid nitrogen fertilizer (28-0-0). ***Mix Instructions:*** Pour directly into liquid fertilizer, mix thoroughly and apply as soon as possible with constant agitation.

3. CROPS: ***Underseeding:*** Not recommended.

beans, black	crambe*	peas (8.7)(canning, field)
beans [dry (field, kidney)]	fababeans (8.6)	shelterbelts**
canola including triazine tolerant (8.8)	mustard (9.0)	sunflowers (9.0)

*Spring application only **Ash (green), caragana, elm (American, Siberian), pine (Scotch).

4. WEEDS CONTROLLED:

barnyard grass (8.3)	buckwheat, wild (8.3)	foxtail (green, yellow) (8.1)	pigweed (8.2)
bluegrass, annual	chickweed (7.1)	knotweed	purslane
brome grass	cockle, cow (9.0)	lamb's-quarters (8.0)	thistle, Russian (7.9)
brome, downy	darnel, Persian	oats, wild (7.5)	

5. WEEDS SUPPRESSED: None.

6. WHEN USED: ***Fall:*** September 1st to freeze-up. **Fall incorporation is discouraged where soil drifting is a problem.** ***Spring:*** Cultivate to destroy existing weeds. Apply immediately prior to, or up to 3 weeks before planting. ***Summer:*** Canola only; on summerfallow between June 1st to September 1st. ***Shelterbelts (transplanted):*** Apply prior to transplanting seedlings.

7. HOW TO APPLY:
With: Ground equipment.
Rate: ***Fall:*** (a) 1.1 L/ac on sandy, sandy loam soils; less than 6% organic matter. (b) 1.4 L/ac on loamy to clay type soils; 6-15% organic matter, and low to medium wild oat infestations. ***Spring:*** (a) 810 mL/ac on sandy, sandy loam soils; less than 6% organic matter. (b) 1.1 L/ac on loamy to clay type soils; 6-15% organic matter; low to medium wild oat infestations. ***Summer:*** 1.7 L/ac on all soils. ***Shelterbelts (transplanted):*** (a) 2.2 L/ac on sandy, sandy loam soils; less than 6% organic matter. (b) 4.4 L/ac on loamy to clay type soils; 6-15% organic matter.
Water Volume: 40 L/ac
Incorporation: First at a right angle, within 8 hours of application. A tandem disc, discer, or field (vibra shank) cultivator is recommended for incorporating to 7.5-10 cm. For best results, operate disc implement at 6.5-10 km/h; cultivator at 10-13 km/h.
Pressure: 275 kPa

8. APPLICATION TIPS: • Do not apply on soils that are wet, in poor tilth, or contain 15% or more organic matter. • To avoid concentrating wild oat seeds below the treated layer, do not plow land prior to Triflurex application. • Use on soils with less than 20-25% straw cover. On stubble, chop and thoroughly mix residues and weed growth into the soil before application. • A tandem disc mixes best on stubble or poor condition soils (crusted, lumpy or wet). Fall application should be followed with 2 incorporations at right angles, before freeze-up. This or a summer application should be preceded by a light spring tillage to a 5-8 cm depth before seeding. • Do not apply with air seeder as it gives non-uniform seeding depth and patchy germination.

9. HOW IT WORKS: Kills seedlings as they germinate. Inhibits cell division in actively growing points of root and shoot.

10. EXPECTED RESULTS: ***Weeds:*** Most die before emerging. Weeds will exhibit swelling in coleoptile region, stubby, thick primary root development and lack of secondary roots, which leads to death due to inadequate moisture obtaining ability.

11. EFFECTS OF RAINFALL: No effect once Triflurex is incorporated into the soil.

12. MOVEMENT IN SOIL: None.

13. GRAZING AND CROPPING RESTRICTIONS: None. ***Crop Use After Hail:*** No restrictions ***Succeeding Crops:*** Normally, carryover will not harm crops grown in rotation. As a precaution, creeping red fescue, oats, sugar beets, small seeded annual grasses such as canary seed grass, or timothy grass should not be grown in rotation following a trifluralin treated crop. Drought conditions in year of treatment may result in higher levels of carryover into the next year. To avoid wheat injury, seed less than 7 cm deep into a warm moist seedbed.

14. TOXICITY: Very low acute mammalian toxicity. Acute oral LD $_{50}$ rats (mg/kg) = (10,000). In clean water, fish are very sensitive, but in run off or muddy water, it binds to soil particles and large amounts can be tolerated by fish. Non-toxic to bees.

15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting. Get medical attention.

16. STORAGE: Do not store below 5°C. If stored below 5°C, bring the contents to 15°C for 24 hours and shake well before using. Do not store near heat, spark or open flame.
NOTE: Similar products, Rival and Treflan, are listed respectively on pages 82 and 101 with additional registrations as follows: ***Crops*** - flax, lentils, soybeans.

TROPOTOX PLUS (MCPB + MCPA)

May & Baker

1. FORMULATIONS: Water soluble solution; 375 g/L MCPB + 25 g/L MCPA; 8 L container.
2. REGISTERED MIXES: None
3. CROPS: Barley (8.8), clover seedlings (alsike (7.2), Ladino, red, white Dutch, wild white), corn (field), oats, pasture, peas (8.1), rye (fall), wheat (spring).
   Underseeding: For clover, can be used on a cereal companion crop.
4. WEEDS CONTROLLED:

bindweed, field (3.2)	lamb's-quarters (8.2)	radish, wild	sow-thistle (annual (5.4),
buttercup (creeping, tall)	mustard (ball, wild, wormseed)(7.9)	ragweed	perennial)
dock, curled	pigweed, redroot (8.3)	rapeseed, volunteer	stinkweed (7.5)
hemp-nettle (5.9)	plantains	shepherd's-purse (5.0)	thistle (bull, Canada (6.1))
horsetail			

5. WEEDS SUPPRESSED: Not applicable.
6. WHEN USED: ***Cereals:*** 2 leaf to flag leaf stage. ***Clover:*** 1-4 true leaf stage. ***Corn:*** after 45 cm high but before tasseling begins, with drop nozzles. ***Pasture:*** after grazing or cutting. ***Peas:*** 3-6 expanded leaves. ***Weeds:*** seedling stage.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 1.1-1.7 L/ac depending on weeds to be controlled.
   Water Volume: 60-80 L/ac
   Pressure: 275 kPa
8. APPLICATION TIPS: Spray in warm weather when plants are actively growing.
9. HOW IT WORKS: A systemic, absorbed by leaves and stems, translocated to actively growing regions, disrupts cell division, ceases cell growth and interferes with respiration and food reserves. Selectivity based on ability of plant to efficiently convert MCPB to MCPA.
10. EXPECTED RESULTS: ***Broad-leaved weeds:*** Should be dead within 2-3 weeks of treatment. ***Poor results may be expected if:*** water volume is incorrect or weeds are too mature.
11. EFFECTS OF RAINFALL: Rainfall before the foliage has dried from the spraying may decrease activity.
12. MOVEMENT IN SOIL: Not applicable.
13. GRAZING AND CROPPING RESTRICTIONS: None listed.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{∞} rate (mg/kg) = (500). Non-toxic to bees.
15. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to avoid exposure. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
16. STORAGE: Store in heated area.

VELPAR (hexazinone)

DuPont

1. FORMULATIONS: Soluble Powder; Velpar; 90%; 25 kg bag. Water Dispersible Solution; Velpar L; 240 g/L; 3.78 L jugs.
2. REGISTERED MIXES: None.
3. CROPS: Non-crop areas only. An industrial herbicide for total vegetation control. Velpar L used for weed and deciduous brush control in coniferous woodland plantations [fir (balsam), pine (red), spruce (black, white)].
4. WEEDS CONTROLLED:

Weeds

bedstraw	dogbane, spreading	lamb's-quarters	spurge, Cypress
bindweed, field	goldenrod	milkweed	thistle, Canada
bromegrass	grape, wild	mullein	toadflax
burdock	grasses (annual, perennial)	poison-ivy	vetch, purple
campion, bladder	ground-ivy	ragweed, common	vine trumpet
carrot, wild	hemp-nettle	ragwort, tansy	
dandelion	horsetail	raspberry, wild	

Brush (Velpar L): Ash, birch, cherry, maple, poplar (aspen).

5. WEEDS SUPPRESSED: None.
6. WHEN USED: ***Herbaceous Weeds:*** just before or soon after weed emergence. Do not apply to frozen or snow covered soil. ***Conifer Site Preparation (Velpar L):*** - in spring after ground has thawed. ***Undiluted Spot Treatment for Brush (Velpar L):*** - to unthawed ground in spring or early summer.
7. HOW TO APPLY:

With: Fixed boom sprayer, handgun, back pack sprayers, a watering can for smaller areas, or a spot gun.

Rate:

Velpar:

Contact Kill or Short Term (3 months): - 1.1-1.8 kg/ac as a foliar spray. ***More than 1 Season:*** - 1.8-3.6 kg/ac as a foliar spray. Higher rates on clay or clay loam soils and on soils with more than 5% organic matter.

Velpar L:

Conifer Site Preparation: - 3.6-7.2 L/ac. Black or white spruce and jack pine may be planted immediately after the 3.6 L/ac application, but should NOT be planted until a year after application at higher rates. ***Undiluted Spot Treatment for Brush:*** 0.75-1.50 mL for each 1 cm of stem diameter (breast height) of plants to be controlled. Direct treatment within 0.5 m of the root collar of plants to be controlled and at least 1.0 m from desirable conifers.

Water Volume: Handgun, minimum of 650 L/ac of spray solution. Velpar L - at least 5 L of water for each L of Velpar L.

8. APPLICATION TIPS: See "Soil Sterilants" page 3. • Avoid overlapping spray swaths. • Velpar - do not apply when vegetation is dormant or semi-dormant as the treatment may not be effective. • Velpar L - do not use on gravelly or rocky soils, exposed subsoil, or sandy soils. • Velpar L - since the effect on conifers varies with soil type, uniformity of application, and environmental conditions, it is suggested growers first test Velpar L on small areas.
9. HOW IT WORKS: A systemic herbicide readily absorbed through the roots and foliage and translocated upwards. Inhibits photosynthesis.
10. EXPECTED RESULTS: Plants become chlorotic soon after treatment and then die. Rainfall will increase efficacy. ***Poor results may be expected if:*** there is inadequate application rate, weed growth too mature, insufficient rainfall or application on areas subject to severe soil erosion.
11. EFFECTS OF RAINFALL: Rainfall less than 4 hours after application may affect the contact activity.
12. MOVEMENT IN SOIL: Velpar moves downward in the soil to the root zone of woody species.
13. GRAZING AND CROPPING RESTRICTIONS: None. ***Succeeding Crops:*** Velpar is a non-selective residual herbicide. Only used on non-crop areas.
14. TOXICITY: Low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (1,690). May cause some eye irritation. Slightly toxic to fish.
15. PRECAUTIONS, FIRST AID: Wear goggles or face shield when applying. Velpar irritates eyes. Velpar L is corrosive to eyes and flammable. Keep away from heat, sparks, and open flame. Wear standard protective clothing (see page 4). IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes.
16. STORAGE: Store in a cool, dry place. Keep away from heat, sparks, and open flame.

PLANT GROWTH REGULATOR

CERONE (ethephon)

Union Carbide

1. FORMULATIONS: Liquid Solution; 480 g/L; 5 L jug.
2. REGISTERED MIXES: None. ***Mixing Instructions:*** To 1/2 required amount of water add Cerone, start agitation, then add the rest of water. Maintain gentle agitation at all times. ***Mixing Restrictions:*** Do not add surfactants or wetting agents as it may result in severe crop injury and reduced yields.
3. CROPS: Barley - Bedford, Bonanza, Galt and Johnston varieties ***only***.
4. WHEN USED: From early flag leaf emergence to swollen-boot stage. Do not apply after the awns have emerged.
5. HOW TO APPLY:
   With: Aircraft or Ground equipment. Do not use control droplet applicators, Spra-Coupes or floaters.
   Rate: 200-335 mL/ac Use the lower rate unless lodging conditions are expected to be severe. Use the higher rates on crops that are heavily fertilized, have ample moisture and are prone to lodging.
   Water Volume: Aircraft - 20 L/ac minimum; Ground - 40-120 L/ac.
   Pressure: Ground - 275 kPa
   Nozzles: Flat fan nozzles recommended.
6. APPLICATION TIPS: • To prevent permanent staining of painted surface, wash all equipment at end of each spray operation. • DO NOT APPLY TO CROPS WHICH ARE UNDER STRESS as severe yield reductions may result.
7. HOW IT WORKS: Uptake primarily through the leaves and stem. Very little translocation throughout the plant.
8. EXPECTED RESULTS: Cerone acts by releasing ethylene in the plant tissues which reduces cell elongation and plant height, usually by 2-15 cm. Cerone applications also strengthen the straw. An occasional delay in maturity may occur. This is normally not greater than 5 days and is generally less than that caused by lodging.
9. EFFECTS OF RAINFALL: Rainfall within 5 hours will decrease activity.
10. MOVEMENT IN SOIL: Not applicable.
11. GRAZING AND CROPPING RESTRICTIONS: ***Drift:*** Avoid drift onto nearby crops as modifications in growth may result. ***Grazing Restrictions:*** Do not graze treated green crop. Treated straw may be fed to livestock. Do not apply within 35 days of harvest. ***Succeeding Crops:*** No restriction.
12. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (4,229). Highly acidic and highly corrosive; contact will cause skin irritation. Over exposure may cause nausea. Inhalation may cause irritation of mucous membranes. Eye contact may cause eye damage.
13. PRECAUTIONS, FIRST AID: Highly corrosive. Wear standard protective clothing (see page 4) plus rubber gloves, goggles, and respirator when handling Cerone. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - do NOT induce vomiting; get immediate medical attention. Drink a large quantity of milk, egg whites, gelatin solution, or if these are not available, drink large quantities of water. Avoid alcohol. Treatment is symptomatic.
14. STORAGE: Do not freeze.

NOTES

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CHEMICAL INSECT CONTROL IN ALBERTA

The degree of infestation and the severity of insect damage vary drastically from area to area and season to season. Some pests, such as grasshoppers and bertha armyworms, require control during periods of abundance which may last from one to several years. Other pests are perennial. For example, sugar beet root maggot is controlled by the application of a granular insecticide with the seed at planting time.

To insure proper use of insecticides identify the pest, learn its biology, check your fields and do not panic when you see an insect in your crop. Obtain information on pending pest problems and keep in mind the previous years' problems so you are prepared for changes in insect population levels.

Chemical Control

Attention to the following points should lead to more effective control: • Insecticides will kill the pest insect if applied properly at a stage when the pest is susceptible. An application that is made too early or too late in the life cycle may not provide adequate control and would be wasteful. • Follow label instructions for proper application. • Learn the biology of the pest. • Base control decisions on the amount of foliage, weather conditions, age and size of the insect and dosage required. Most insecticides have limited residual control properties when applied to foliage. If insects are moving into crops or emerging over an extended period, several applications in the same season may be necessary.

Safety

In general, insecticides are more toxic to humans, wildlife, fish, bees and other non-target organisms than herbicides. Follow label directions for safety precautions associated with application of each insecticide. Refer to pages 2-8 for general information on pesticide toxicity, exposure, safety precautions, protective equipment, symptoms, first aid, poison control centres, and disposal. Specific information on safety is included with each insecticide.

Bee Safety

Honey bees and other pollinators are susceptible to most insecticides. If applications are made to weeds or crops in bloom, severe pollinator mortality may occur. To reduce this risk, apply insecticides in late evening (most preferred) or early morning when bees are not flying. Advise beekeepers in the area to be sprayed at least 48 hours before application. Never allow insecticide spray to drift directly onto an apiary site. Do not apply insecticides to water bodies.

Livestock and Residues

The number of days between application of an insecticide and harvesting, feeding to livestock, or grazing is given on the label. These restrictions must be followed to prevent illegal residues and eliminate hazards to consumers. Follow label instructions.

The Manual

This manual includes only the major insecticides registered for use in Alberta. Not all insects controlled are listed for each pesticide; see the labels for complete listings.

AMBUSH, POUNCE (permethrin)

Chipman / Chemagro

1. FORMULATIONS: Emulsifiable Concentrates - (Ambush); 500 g/L; 6 X 1 L, 4 x 5 L pack. (Pounce); 384 g/L; 1 L jug. Granular; (Ambush); 1%;

2. CROPS:

barley	corn	lentils	peas	rye	sunflowers
canola	flax	oats	potatoes	sugar beets	wheat

3. INSECTS CONTROLLED: Colorado potato beetle, corn earworm, cutworms (army, pale western, red-backed), European corn borer, fall armyworm, potato flea beetle, potato leafhopper, tarnished plant bug.

4. WHEN USED: Post-Planting Treatment: ***Cutworms*** - Applications should be made under warm, moist conditions in the evening or at night when cutworm activity is highest. ***Corn Borer, Corn Earworm*** - Spray no later than when first feeding damage is seen on foliage. For 2nd brood borers in late plantings, apply before tassels show.

5. HOW TO APPLY:
With: Ground equipment only.
Rate: higher rate for heavy infestations (anticipated or actual), when adult insects are present, dense foliage, or (cutworms) when soil is dry.

Crop	Insect	Formulation	Quantity/ac
Barley, canola, corn, flax, lentils, oats, peas, potato, rye, sugar beets, sunflowers, wheat.	Cutworms (army, pale western, red-backed)	Ambush 500 EC	57-121 mL
Corn (sweet)	Corn earworm, European corn borer.	Ambush 500 EC	81-111 mL
		Ambush 1%	4 kg
		Pounce	111-151 mL
	Fall armyworm	Ambush 500 EC	57 mL
Potato	Colorado potato beetle, potato flea beetle, potato leafhopper, tarnished plant bug.	Ambush 500 EC	57-81 mL
		Pounce	75-111 mL

Water Volume: Corn: Ambush 130-180 L/ac; Pounce 140-180 L/ac. Potato: sufficient water for thorough coverage of foliage.

6. APPLICATION TIPS: Corn - Corn earworm, direct spray to ensure coverage of ears and silk. European corn borer control, consult with agricultural personnel for proper timing of spray.

7. HOW IT WORKS: Works by contact and as a stomach poison on a wide range of pests. Good residual activity. No systemic or fumigant activity.

8. GRAZING AND HARVEST RESTRICTIONS: Cover crop or crop treated with permethrin should not be used as a green feed for animals. Pre-harvest interval (days): corn (1), potatoes (1).

9. TOXICITY: Low Acute oral LD_{50} rats (mg/kg) = 3000 (Ambush 500EC), 1030 (Pounce EC). Severe eye irritant. Very toxic to bees and fish.

10. PRECAUTIONS, FIRST AID: Wear protective equipment to avoid contact with skin and eyes. Do NOT inhale spray mist. Do not spray when bees are foraging. Spray deposit should be dry before bees commence foraging in treated crops. Keep product away from fire, open flame, electric light bulbs and other sources of heat. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - do NOT induce vomiting or administer liquids; product contains petroleum distillates. Get medical attention immediately.

11. STORAGE: Heated storage required.

COUNTER (terbufos)

Cyanamid

DANGER POISON

1. FORMULATIONS: Granular - Counter 5-G; 5%; 20 kg bag, 500 kg mini-bulk bag. - Counter 15-G; 15%; 25 kg bag.
2. MARKETING CATEGORY: Restricted (products to be stored or displayed apart from food or feed).
3. REGISTERED MIXES: 5-G may be mixed with fungicide treated seed.
4. CROPS: Canola, corn (field, sweet), mustard, sugar beets.
5. INSECTS CONTROLLED: Flea beetle, seed corn maggot, sugar beet root maggot, wireworms.
6. WHEN USED: ***Corn, sugar beets*** - do not apply later than at planting time. ***Canola, mustard*** - treat seed before planting.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: If extreme infestations are anticipated use the higher rate.

Crop	Insect	Formulation	kg/ac
Canola, mustard.	Flea beetle	5-G	2.2-4.5
Corn	Seed corn maggot, wireworms.	15-G	75 g/100 m row (minimum 75 cm row spacing)
Sugar beet	Sugar beet root maggot, wireworm.	15-G	45 g/100 m row (minimum row spacing of 50 cm)

   Incorporation: ***Canola, mustard*** - carefully blend seed and granules together using a mechanical mixer or stirring with a stick in the drill box. ***Corn*** - place in a 18 cm band over the row directly behind the planter shoe in front of the press wheel or place directly in the seed furrow behind the planter shoe. ***Sugar beets*** - apply in furrow, 5-8 cm behind the seed drop zone after some soil has covered the seed.
8. APPLICATION TIPS: • Do not place 15-G granules in direct contact with seed. • When a seed treatment is also used - mix the seed treatment with seed, then mix granules with treated seed. • Cover granules that may be exposed on the ends of the treated rows, turns, and field loading areas. • Empty hoppers of equipment while still in the field.
9. HOW IT WORKS: Terbufos is a systemic, organophosphorus insecticide with effective initial and residual activity.
10. GRAZING AND HARVEST RESTRICTIONS: Sugar beet tops and beet pulp may be fed to livestock after harvest.
11. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (1.6). Highly toxic to fish, birds, and other wildlife.
12. PRECAUTIONS, FIRST AID: Rapidly absorbed through skin. Repeated inhalation or skin contact may, without symptoms, progressively increase susceptibility to poisoning. While transferring from package to equipment, wear a clean cap and gloves (rubber or cotton). Cotton gloves must be laundered or discarded after each day's use. Clothes and rubber gloves should be washed with soap and water after each use. Do not wear the same gloves for other work. Wash thoroughly with soap and water before eating, drinking or smoking. Bathe at the end of the work day, and change outer clothing. DO NOT BREATHE DUST - While emptying bags into equipment, pour downwind and allow as little free fall as possible. Do not pour at face level and do not allow dust to reach the breathing zone. Sweep up and bury spillage whether it occurs indoors or in the field. Once a bag has been opened, use it completely or bury the remainder. Keep all unprotected persons out of the operating areas. KEEP OUT OF REACH OF CHILDREN AND ANIMALS. ***Symptoms of poisoning:*** weakness, headache, tightness of chest, blurred vision, non-reactive pinpoint pupils, salivation, sweating, nausea, vomiting, diarrhea or abdominal cramps. ***First Aid:*** CALL A PHYSICIAN AT ONCE IN ALL CASES OF SUSPECTED POISONING. IN EMERGENCY endangering life or property, call collect, day or night, 1-613-996-6666. **Antidote** is atropine. Consult your physician about obtaining a supply of 0.65 milligram tablets for emergency use. If symptoms of poisoning occur, do not wait for a physician but take 2 tablets at once. Do not take atropine unless symptoms of poisoning have occurred. Anyone who has been sick enough to have taken atropine must be seen by a physician as soon as possible.
    IF INHALED - remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
13. DECONTAMINATION AND DISPOSAL: All mixing equipment must be rinsed with the decontamination solution.
    Decontamination Solution: Into 10 L of water slowly and carefully add in sequence 130 g detergent followed by 525 g caustic soda (lye) and finally 1.2 litres of commercial bleach (sodium hypochlorite). Handle and use the solution with great care. Do not add water to dry lye. If spill occurs on floor areas, use a sweeping compound to clean up. Decontaminate the waste with decontamination solution. Wash floor with decontamination solution and rinse well with clean water. Clean up solution and rinse water with absorbent materials such as sawdust, sweeping compound, rags, etc.

CYGON (dimethoate)

Cyanamid / Chipman / Peacock Industries

1. FORMULATIONS: Emulsifiable Concentrate; – 480 g/L; Cygon (480E, 4-E), Sys-tem 480 EC; 10 L jug. – 480 g/L; Cygon Hopper-Kill; 20 L can. Bran Bait; 5.2%; Cygon Hopper Stopper; 20 kg bag (see Bait directions).
2. CROPS: Alfalfa, barley, beans, canola, clovers, corn, flax, oats, pastures, potatoes, rye, sugar beets, sunflowers, waste areas, wheat.
3. INSECTS CONTROLLED: Alfalfa weevil larvae, aphids, grasshoppers (adult, winged young), leafhoppers, lygus bugs, mites, plant bugs, stink bugs, sweet clover weevil, tarnished plant bugs, thrips.
4. WHEN USED: Apply when insects or damage first appears. Repeat as necessary.
5. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: lower rate for young insects, minor infestations or sparse foliage; higher rate for adult insects (winged grasshoppers and beetles), severe infestations or dense foliage.

Crop	Insect	mL/ac	Crop	Insect	mL/ac
Alfalfa, clovers, pastures, waste areas.	Aphids, young grasshoppers.	180	Beans	Aphids, leafhoppers, leafminers, lygus bugs, tarnished plant bugs.	225-405
	Leafhoppers, lygus bugs, plant bugs, alfalfa weevil larvae, pea aphid.	175-450			
	Adult or winged grasshoppers.	340-360	Canola	Aphids, grasshoppers.	340-360
Barley, oats, rye, wheat.	Grasshoppers, aphids, stink bugs.	175-400			
Barley, oats, rye, wheat.	Thrips	400	Clover (sweet)	Sweet clover weevil	340-400
			Potato	Aphids, leafhoppers.	225-450

   NOTE: Check each specific label to insure the insect is included on that label.
   Water Volume: 18 L/ac for good coverage. Potatoes - 80 L/ac minimum.
6. APPLICATION TIPS: • Not suitable for application in oil. • Do not use when bees are foraging. • When using foliar sprays, do not apply during heat of the day or when temperatures are excessively high.
7. HOW IT WORKS: Dimethoate is a broad-spectrum, systemic and contact, organophosphate insecticide and acaricide.
8. GRAZING AND HARVEST RESTRICTIONS: Remove cattle prior to spraying. Pre-harvest and pre-grazing intervals depend on rate used. Do not harvest or graze within (days): 170-220 mL/ac - (2); 340-360 mL/ac - canola (7), grains (21); 360-450 mL/ac - (28). Do not harvest potatoes within 7 days.
9. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (320-380). Highly toxic to birds, bees, and other animals.
10. PRECAUTIONS, FIRST AID: ***Protective Equipment:*** Wear a respirator, goggles, rubber gloves, rubber boots, and coveralls when handling concentrate to avoid contact with skin and eyes. Do not inhale spray mist. Use in adequately ventilated area. Do not use or spill or store near heat or open flame. Do not use when bees are foraging. ***Symptoms of poisoning:*** anorexia, nausea, vomiting, pinpoint pupils, excessive salivation, muscle twitching, convulsions or coma. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention in all cases.
11. STORAGE: Store between 5°C and 30°C, away from feed and food.
12. DECONTAMINATION AND DISPOSAL: ***Spills*** - scrub contaminated area immediately with a strong laundry soap solution or use household lye - detergents are not satisfactory. Repeated scrubbings are necessary on plain wood surfaces.

    HOPPER STOPPER BRAN BAIT ***Application:*** Applied dry and broadcast evenly to control grasshoppers. Use no more than once a week for heavy infestations; no more than once every 2 weeks for moderate to low infestations. Do not contaminate bodies of water, food or feed. ***Rate:*** 0.8-1.2 kg/ac. Non-toxic to pollinators if applied as directed. ***Beef Cattle*** do not have to be removed during treatment. ***Dairy Cattle:*** do not graze or harvest forage for 48 hours. ***Grain Crops:*** do not harvest for 21 days after treatment.

CYMBUSH, RIPCORD (cypermethrin)

Chipman/Ciba-Geigy

1. FORMULATIONS: Emulsifiable Concentrate; - Cymbush 260 g/l; 1 L, 5 L jugs. - Ripcord 400 EC; 1 Ljug.
2. REGISTERED MIXES: None.
3. CROPS: ***Cymbush:*** corn, potatoes, rapeseed (canola), sunflowers. ***Ripcord:*** barley, headlands, rapeseed (canola), roadsides, summerfallow, wheat.
4. INSECTS CONTROLLED:

Cymbush			Ripcord
bertha armyworm	European corn borer	sunflower beetle	flea beetle
Colorado potato beetle	potato flea beetle	tarnished plant bug	grasshoppers
crucifer flea beetle	potato leaf hopper	tuber flea beetle	

5. WHEN USED: Apply when damage is first noticed. Do not apply more than 3 times per season.
6. HOW TO APPLY:
   With: Ground equipment.
   Rate:

Crop	Insect	Product	mL/ac
Barley, headlands, rapeseed (canola), roadsides, summerfallow, wheat.	Grasshoppers	Ripcord	20-28
Corn	European corn borer	Cymbush	113
Potatoes	Colorado potato beetle, potato flea beetle, potato leaf hopper, tuber flea beetle.	Cymbush	57
	Tarnished plant bug	Cymbush	81
Rapeseed (canola)	Crucifer flea beetle	Cymbush	57
	Flea beetles	Ripcord	14-20
	Bertha armyworm	Cymbush	81-112
Sunflowers	Sunflower beetle	Cymbush	41

   Water Volume: Corn: 130-180 L/ac. Potatoes, rapeseed (canola), sunflower- 40-50 L/ac.
   Pressure: 250-300 kPa.
7. APPLICATION TIPS: • 15 m buffer zone from water must be maintained. • ***Corn*** direct spray to ensure coverage of ears and silk. Consult your local provincial agriculturists for proper timing of spray. • Avoid application when temperatures are above 27° C.
8. HOW IT WORKS: By contact and stomach action. Good residual activity. No systemic or fumigant activity.
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days) Ripcord: barley (60); canola, wheat (30). Pre-harvest interval (days) Cymbush: canola (30), corn (5), potatoes (7), sunflowers (70). Cover crop or crop treated with cypermethrin must not be used as a green feed for animals.
10. TOXICITY: Low-moderate mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = Cymbush (760); Ripcord (1,656). Very toxic to bees and fish.
11. PRECAUTIONS, FIRST AID: Harmful or fatal if swallowed or absorbed through skin. Avoid contact with eyes and clothing. Spray mist must be dried before bees commence foraging in treated crop. ***First Aid:*** If swallowed - do NOT induce vomiting, this product contains petroleum distillates. Get medical attention immediately.
12. STORAGE: Store in heated chemical shed.

DECIS (deltamethrin)
Hoechst

1. FORMULATIONS: Emulsifiable Concentrate; Decis 5 EC; 50 g/L; 2.5 L jugs.
2. REGISTERED MIXES: Hoe-Grass II, Hoe-Grass 284. ***Mix Restrictions:*** Do not mix product with any other chemicals, additives, or fertilizers.
3. CROPS: ***Decis 5 EC:*** Alfalfa (for seed production only), barley, canola, flax, lentils, mustard, oats, potatoes, sunflowers, wheat (all types).
4. INSECTS CONTROLLED:

Decis 5 EC

alfalfa weevil	cutworms	grasshoppers	sunflower beetle
bertha armyworm	diamondback moth	leafhoppers	tarnished plant bug
clover cutworm	flea beetles	lygus bugs	
Colorado potato beetle		potato flea beetle	

5. WHEN USED: when insects or damage first appears. Apply to young (non-flying) grasshoppers (2-4 nymphal stage) for best results. ***Sunflower beetle:*** when crop is in the cotyledon to 2 leaf stage. ***Number of applications:*** Maximum of 1 application per year on bertha armyworm, cutworms, diamondback moth, flea beetle, potato flea beetle, sunflower beetle. Other pests, maximum of 3 applications per year. Only 2 applications to a field by air per year.
6. HOW TO APPLY:
With: Aircraft - Barley, canola, flax, lentils, mustard, oats, potatoes, sunflowers, wheat. Ground equipment - All crops.
Rate: Higher rate for severe infestations on dense foliage, or when adult insects are present.

Crop	Insect	Decis 5 EC (mL/ac)
Alfalfa (seed production only)	Alfalfa weevil, lygus bugs.	80-200
Barley, flax, lentils, oats, wheat.	Cutworms	80
	Grasshoppers	40-60
Canola, mustard.	Bertha armyworm, clover cutworm, diamondback moth, flea beetles.	40-60
Potato	Colorado potato beetle, leafhoppers, potato flea beetle, tarnished plant bug.	40-60
Sunflowers	Sunflower beetle	40

NOTE: On high organic (muck) soils: apply 80 mL/ac. Apply only once during each crop year, prior to August 1.
Water Volume: Air - 4.4-8.8 L/ac. Ground - alfalfa 40-120 L/ac; Canola, mustard 40 L/ac; Cereals 40-80 L/ac; Potatoes 80-200 L/ac.
Pressure: Air: 200 kPa minimum. Ground: 275 kPa.
Nozzles: Aerial droplet size: 150-250 micron range recommended. Flat fan only recommended.

7. APPLICATION TIPS: • ***Air application:*** leave 100 m border between edge of treated fields and environmentally sensitive areas (e.g. wetlands, sloughs, rivers, houses, farm buildings). • Best control will be achieved if applied during the morning or evening. • Do not spray under a strong temperature inversion, or when temperature exceeds 25°C. • With severe flea beetle and grasshopper infestations, spray fence rows and a 15 m strip into adjacent summerfallow and cropped fields.
8. HOW IT WORKS: Deltamethrin is a non-systemic, synthetic pyrethroid which works by contact and ingestion.
9. EXPECTED RESULTS: Speed of kill is dependant on target insect and environmental conditions. Death may occur as rapidly as 2 hours.
10. EFFECTS OF RAINFALL: Do not apply within 1 hour of rain.
11. MOVEMENT IN SOIL: Becomes fixed on soil colloidal particles and broken down by micro-organisms.
12. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): canola, mustard (14); cereals, flax (40); potatoes (23); sunflowers (70). Do not graze treated fields. Do not feed treated crops to livestock, including crops damaged by hail.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD $_{50}$ rats (mg/kg) = (395). Severe eye and skin irritant. Very toxic to aquatic organisms and fish. Toxic to bees and other beneficial insects.
14. PRECAUTIONS, FIRST AID: Wear goggles or face shield and protective clothing to protect skin and eyes. Do not inhale. Keep away from fire, open flame and other sources of heat. Do not apply when bees are foraging. ***Symptoms of poisoning:*** neurological dysfunction, such as convulsion with severe poisoning. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Treat irritated skin area with Nivea cream. IF SWALLOWED - Do NOT induce vomiting or administer liquids. This product contains xylene. Get medical attention immediately.
15. STORAGE: Do not store below freezing. Do not store near feed or food. Keep away from heat, sparks and open flames.

DIAZINON, BASUDIN (diazinon)

Chipman / Ciba-Geigy

1. FORMULATIONS: Wettable Powder (WP)- Diazinon 50W; 50%; 10 X 1.5 kg pack. Basudin 50W; 50%; 10 X 2 kg pack. Emulsifiable Concentrate (EC) - Diazinon 500; 500 g/L; 4 X 4 L, 20 L can. Basudin 500EC; 500 g/L; 4 X 4 L pack.
2. REGISTERED MIXES: When using WP as a seed treatment for corn and sugar beets, mix with a fungicide (75% captan or 75% thiram).
3. CROPS: Beans (all types), corn, hay, non-crop areas, pasture, peas, potatoes, rangeland.
4. INSECTS CONTROLLED: Aphids, Colorado potato beetles, flea beetles, grasshoppers, leafhoppers, leafminers, root maggots.
5. WHEN USED: Treat seed within 3 months of planting. Spray when insects first appear. Repeat as necessary.
6. HOW TO APPLY:
   With: Ground equipment.
   Rate:

Crop	Insect	Formulation	Quantity
Seed Treatment - Corn, Peas, Beans (all types including lima, snap, field, soybeans).*	Root maggots	Basudin 50W	17 g/bushel of grain
Potatoes	Aphids, Colorado potato beetle, flea beetles, leafhoppers, leafminers.	WP	400-455 g/ac
		EC	445 mL/ac
Hay, non-crop areas, pasture, rangeland.	Grasshoppers	WP	455 g/ac
		EC	445 mL/ac

   NOTE: *If seed has not been treated with a fungicide, use 75% captan or 75% thiram at the rate given on fungicide label, otherwise injury to seed may result.
   Water Volume: Use sufficient water to obtain thorough coverage.
7. APPLICATION TIPS: • Seed treatment (corn, beans) - add correct amount of Basudin 50W to 285 mL of water for each bushel to be treated and thoroughly mix seed. Dry seed before bagging or planting. • Seed treatment (potato pieces) - immerse in solution. • Do not apply during bloom to avoid injuring pollinating insects.
8. HOW IT WORKS: A non-systemic, organophosphate insecticide which works by contact and ingestion. Deteriorates rapidly in solution and in containers once opened.
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval for potatoes 14 days. Do not cut hay for 21 days after treatment.
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (250). Toxic to bees, fish, and other animals.
11. PRECAUTIONS, FIRST AID: Wear protective gear,including rubber gloves to avoid contact with skin or eyes - do not inhale spray mist. Label treated seed, ***"Do not use for food or feed. This seed has been treated with diazinon. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** headaches, giddiness, blurred vision, nervousness, weakness, nausea, cramps, diarrhea, discomfort in the chest, sweating, pinpoint pupils, tearing, salivation, vomiting, uncontrolled muscle twitching, convulsions, or coma. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
12. STORAGE: Do not store or use EC near heat or open flame. Flash point 27°C.
13. DECONTAMINATION AND DISPOSAL: ***Spills on concrete floors:*** surround and cover spill with a granular carrier such as Attaclay, (cat litter). Allow carrier to absorb the liquid, then shovel into a container for disposal by burying. Wash the floor with a weak lye solution to remove any trace of pesticide. ***Spills on wooden floors:*** use same procedure as for concrete floor but repeat washing until odor disappears.

DYLOX (trichlorfon)
Chemagro

1. FORMULATIONS: Soluble Powder; 80% by weight; 12 X 2.3 kg pack. Solution; 420 g/L; 20 L container.
2. REGISTERED MIXES: ***Mixing Instructions:*** Powder - to dissolve, pour the required amount into full amount of water, then agitate. Use immediately after mixing.
3. CROPS: Alfalfa, barley, beans (dry, lima, snap), canola, corn (field, popcorn, sweet), flax, oats, sugar beets, wheat.
4. INSECTS CONTROLLED:

alfalfa caterpillar	cutworms, variegated	imported cabbageworm	tarnished plant bug
armyworms (beet, bertha, common, true, western yellow-striped)	diamondback moth	lygus bugs	webworm (alfalfa, beet)
	dipterous leaf miner	stink bugs	

5. WHEN USED: ***Alfalfa*** - 1 application per cutting. ***Barley, flax, oats, wheat*** - repeat as necessary prior to flowering or head emergence but not after flowering to flax; 1 additional application may be made to barley, oats, and wheat after heads emerge from sheath. ***Beans*** - Repeat as necessary. Do not apply to lima beans after pod set. ***Canola, sugar beets*** - repeat as necessary. ***Corn (field, sweet)*** - maximum of 3 per season with either formulation. Early applications when plants are 8-30 cm tall.
6. HOW TO APPLY:
With: Aircraft or Ground equipment.
Rate: Low rate for immature insects, light infestations or sparse foliage. ***Exception:*** webworm control on sugar beets, use higher rate with low volume air application.

Crop	Insect	Powder g/ac	Liquid L/ac
Alfalfa	Alfalfa caterpillar	210-285	0.4-0.6
	Alfalfa webworm	140-610	0.28-1.1
	Beet armyworm, variegated cutworm.	285-610	0.6-1.1
	Lygus bugs, stink bugs, tarnished plant bug.	610	1.1
Barley, flax, oats, wheat.	Armyworms (common, true, western yellow-striped).	285	0.6
	Beet webworm, variegated cutworm.	285-610	0.6-1.1
	Bertha armworm	610	1.1
Beans	Armyworms, imported cabbageworm, dipterous leaf miner, lygus bugs, stink bug, variegated cutworm.	610-910	1.1-1.6
Canola	Beet webworm	285	0.6
	Diamondback moth	610	1.1
Corn (field, sweet)	Armyworms, cutworms.	285-610	0.6-1.1
Sugar beet	Beet webworm	140-285	0.3-0.6
	Dipterous leaf miners, variegated cutworm.	285-610	0.6-1.1
	Alfalfa webworm, beet armyworm.	610-910	1.1-1.6

7. APPLICATION TIPS: • Powder dissolves readily in water and is suitable for use in all power-operated ground sprayers and aircraft sprayers. Soluble powders should be used in sprayers equipped with 0.3 mm or larger screens. If 0.15 mm screens are used, some screen clogging may occur. • Trichlorfon is a selective insecticide: beneficial insect species are less affected. This selective advantage is lost when product is used in conjunction with or alternated with non-selective pesticides. • ***Corn:*** for early applications to control armyworms and cutworms, spray when plants are 8-30 cm high; direct the spray to the lower portions of the plant. Later applications may be made as full coverage. • Do not apply to or allow spray drift onto varieties of sorghum which are sensitive to phosphates.
8. HOW IT WORKS: Trichlorfon is an organophosphate insecticide which works by contact and ingestion.
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest or pre-grazing interval (days): alfalfa (14); barley, flax, oats, wheat (21); beans (14); canola (21); corn (0); sugar beets (14). Sugar beets - do not feed tops harvested within 28 days of treatment.
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (144).
11. PRECAUTIONS, FIRST AID: Wear standard protective clothing (see page 4) to protect skin and eyes. Do not inhale spray mist. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** tightness in the chest, sweating, contracted pupils, stomach pains, vomiting, and diarrhea. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately. ***For Physician:*** **Antidote is atropine sulphate** administered in large therapeutic doses repeated as necessary to the point of tolerance. 2-PAM is also antidotal and may be administered in conjunction with atropine. Do NOT give morphine.
12. STORAGE: Store liquids above 0°C and away from excessive heat and open flame. Store in an area specially designated for pesticides. Do not store near any material intended for use or consumption by humans or animals.

FURADAN (carbofuran)

Chemagro

1. FORMULATIONS: Granular; Furadan 10G, CR-10; 10%; 20 kg bag. Flowable; Furadan 480; 480 g/L; 4 X 4 L pack, 18.9 L pail.

2. REGISTERED MIXES: Furadan 480 - all formulations of 2,4-D and MCPA (use only on crops listed on both labels). Compatible with most fungicides. Do not mix with Bordeaux mixture or hydrated lime.

3. CROPS: Alfalfa, barley, canola, clover (sweet), corn (field, silage, sweet), flax, headlands, mustard, oats, pastures, potatoes, roadsides, sugar beets.

4. INSECTS CONTROLLED:

alfalfa weevil	European corn borer	leafhoppers	sugar beet root maggot
aphids	flea beetles	potato flea beetles	tarnished plant bug
Colorado potato beetle	grasshoppers	potato leafhoppers	

5. WHEN USED: ***Alfalfa weevil*** - when 25% of the alfalfa tips show feeding damage. Maximum of 1 application per season. ***Aphids, Colorado potato beetle, potato flea beetle, potato leafhopper, tarnished plant bug*** - as soon as the first insects are noticed and repeat as necessary. ***European corn borer*** - no later than when first feeding is seen on foliage. For second brood borers in late plantings, apply before tassels show. ***Flea beetles*** - about 2 weeks after seeding or when insects are noticed. Maximum 2 applications per season. ***Grasshoppers*** - when grasshoppers are present. Maximum applications per season: canola, flax, mustard (1); cereals, headlands, legumes, pastures, roadsides (2); corn (4).

6. HOW TO APPLY:

(A) Granular

With: ***CR-10:*** hoe or press drill ***10G:*** insecticide application attachment.

Rate: Higher rate if a severe infestation is anticipated.

Crop	Insect	Formulation	kg/ac
Canola, mustard.	Flea beetles	CR-10	1.1
Potatoes	Colorado potato beetle, potato flea beetle, leafhoppers.	10G	13.6 (using 90 cm row spacing or 300 g/100 m of row)
Sugar beet	Sugar beet root maggot	10G	3.4

Incorporation: ***Canola, mustard:*** for seed drill application only; not valid for application with discer seeders. Efficacy can be reduced by harrowing after seeding. Mix granules and seed thoroughly. Check for accurate calibration. ***Potatoes:*** apply as a 10 cm wide band into seed furrow or drill into the soil 10 cm on each side of row and 5 cm below seed. ***Sugar beets:*** apply directly into seed furrow at same depth as seed or slightly above seed. Do not mix seed, fertilizer and insecticide in same hopper.

(B) Flowable

With: Aircraft or Ground equipment.

Rate: higher rate for severe infestations.

Crop	Insect	mL/ac
Alfalfa	Alfalfa weevil	225
Alfalfa; barley; canola; clover (sweet); corn (field, sweet); flax; headlands, mustard; oats; pasture; roadsides; wheat.	Grasshoppers	110
Canola, mustard.	Flea beetles	60-110
	Red turnip beetle	110
Corn (field, silage, sweet)	European corn borer	445
Potatoes	Any of: aphids, potato flea beetle, potato leafhopper or tarnished plant bug alone or with Colorado potato beetle.	445
Potatoes	Colorado potato beetle	225

Water Volume: Air - 8 L/ac minimum. Ground - 40 L/ac minimum. Potatoes - 325-405 L/ac. Use sufficient water for thorough coverage.

Pressure: Potatoes - 275 kPa minimum.

7. APPLICATION TIPS: • Check the label for calibration of various types of granular applicators. • If seed decay, seedling blight or damping-off diseases are a problem, treat seed with a recommended fungicide. • Canola and mustard may also require a foliar treatment after seeding with granules. Check fields shortly after emergence. • Do not use on fields subject to flooding. • Boom sprayers - equip with hydraulic or mechanical agitation and 50 mesh screens; remove any felt filters.

8. HOW IT WORKS: Carbofuran is a broad-spectrum, systemic, carbamate insecticide, acaricide and nematicide.

9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest or pre-grazing interval (days): Alfalfa (weevils 7, grasshoppers 1); barley, flax, mustard, oats, wheat (21); canola (60); clover (sweet)(28); corn (7); headlands, pasture, roadsides (1); potatoes (7). Sugar beet tops and pulp may be fed to livestock without causing residues in milk or meat.

10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (11). Highly toxic to bees, waterfowl, birds, fish, and other wildlife.

11. PRECAUTIONS, FIRST AID: Wear coveralls, goggles, and respirator (e.g. American Optical 6058 or Willson Agritox respirator with appropriate filter or cartridge) at all times. Do not breathe spray mist or dust. NEVER handle product with bare hands. Use rubber or neoprene gloves, do NOT use leather gloves. When handling toxic materials do not carry cigarettes, or edibles on your person and do not smoke, eat, chew gum or tobacco while conducting mixing or loading operations. Change clothes each day. Wash clothes in detergent, bleach and hot water. Take a bath at the end of each day. ***Symptoms of poisoning:*** blurred vision, nausea, excessive perspiration, weakness, headache, light-headedness; constriction of pupils, cramps, salivation and vomiting. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Repeat until vomit is clear. Victim should be lying face down or on the side with head below foot level. Secure medical attention immediately.

12. STORAGE: Protect flowable from freezing.

GASTOXIN (phosphine)

Sanex

1. FORMULATIONS: Tablets, 3 g; release 1 g phosphine upon decomposition; 1 kg flask. Pellets, 0.6 g; release 0.2 g phosphine upon decomposition; 1 kg flask.

2. MARKETING CATEGORY: Restricted. A permit must be obtained from your local Agricultural Fieldman or Alberta Environment prior to purchase or use of these products.

3. REGISTERED USES: Raw agricultural products, grain, processed foods and feeds.

4. INSECTS CONTROLLED:

almond moth	dermestids	Indian meal moth	pink bollworm
Angoumois grain moth	dried fruit moth	khapra beetle	raisin moth
bean weevil	rusty grain beetle	lesser grain borer	saw-toothed grain beetle
cadelle	flour beetles	Mediterranean flour moth	tobacco moth
cigarette beetle	granary weevils		

5. WHEN USED: when the temperature is above 5°C.

6. HOW TO APPLY:
Rate: ***Raw agricultural commodities, grain and bulk animal feeds:*** 4-6 tablets/m³ (60-180/1000 bu.), or 5-10 pellets/m³ (120-300 pellets/1000 bu.). ***Processed foods:*** 16 tablets/10 m³ (30-60/1000 ft.³) or 6 pellets/m³ (100-200/1000 ft.³) of storage space. ***Cereal mills, feed mills, warehouses:*** 7-11 tablets/10 m³ (20-30/1000 ft³) or 4-6 pellests/m ³ (100-150/1000 ft³) of storage space.

Commodity temp. °C	Tablets - Exposure Times (days)	Pellets - Exposure Times (days)
over 20	3	2
6-20	4	3
12-15	5	4
5-11	10	9
below 5	Do not fumigate	Do not fumigate

NOTE: Suggested exposures should be observed. A shortened exposure period cannot be compensated for by increased dosage.

7. APPLICATION TIPS: ***General:*** NEVER fumigate alone. Have appropriate gas detection devices available for use as needed. NEVER fumigate any structure or area unless it is unoccupied. ***Fumigating Flat Storages (Quansets, granaries):*** • Make certain that the structure is tight enough to be fumigated successfully. Seal structure as needed. Make certain that there are no adjoining structures occupied by man or animals. During fumigant application leave all doors or other openings open to create a cross ventilation. • Application can proceed for 2-4 hours or until the odor of phosphine is detected in the overspace. Apply the tablets or pellets using a pipe. Make probes every 4-5 feet horizontally across the grain in both directions. The number of tablets or pellets used per probe is determined by dividing amount of fumigant to be used by number of probings to be made. Fumigant is dropped in the pipe at intervals as the pipe is withdrawn from the grain. • A plastic tarp may be pulled over the grain surface following application. This reduces convection currents and increases the effectiveness of the fumigant. Care must be taken to see that the plastic is removed when fumigation is completed (no more than 5-6 days or sweating of grain may occur). • Close and seal all external openings. Placard and lock all entrances. Following the exposure period, open doors and windows creating a cross draft to aid in aeration. Make certain all warning signs are removed when aeration is complete.

8. HOW IT WORKS: Phosphine (hydrogen phosphide) is a colourless gas with a carbide-like odour and high volatility. Formulated product consists of aluminium phosphide, ammonium bicarbonate, urea and paraffin. Upon exposure to air, the ammonium bicarbonate breaks down to form ammonia (a pungent, warning gas) and carbon dioxide (a fire suppressant). Within 1-4 hours, depending on temperature and humidity, the product begins to release phosphine and decompose.

9. EXPECTED RESULTS: The effectiveness of fumigation is primarily dependent upon temperature, tightness of seal, the type of storage space, exposure time and dosage. Therefore, a range of dosages and exposure times are suggested.

10. RESTRICTIONS ON TREATED GOODS: Aerate finished food for 48 hours before it is offered to the consumer.

11. TOXICITY: Hydrogen phosphide gas is very toxic to all forms of animal life, and exposure to even small amounts should be prevented. Poisoning results from ingestion or inhalation as hydrogen phosphide is not absorbed through the skin. It is also insoluble in water, fats, and oils.

12. PRECAUTIONS, FIRST AID: ***Protective Equipment:*** • It will be necessary to wear a gas mask if: (a) structure under fumigation must be entered in case of emergency or (b) a structure must be entered to commence aeration procedure. Otherwise, it is not necessary to wear a gas mask when product is applied according to label directions. Wear gloves when handling the product. • Open containers only in open air and with the opening pointing away from your face. Use entire contents of a tube once it is opened. Unopened tubes and resealable flasks may be returned to the locked storage area for later use. Wash hands after use of the product. ***Reduce Gas Hazards:*** • NEVER let tablets or pellets come in direct contact with liquid - this causes the immediate release of hydrogen phosphide. • NEVER confine the product in small gas proof enclosures such as plastic bags. Such confinement could cause the gas concentration to reach the lower flammability level. • Take precautions in areas where copper, brass or gold are present, as corrosion may occur. NEVER fumigate in areas containing electronic or telephone equipment, photographic film or copy paper. It may be possible to remove such items or protect them from exposure to the gas. • Hydrogen phosphide has great penetrating power and gas may slowly seep through concrete block walls. Hydrogen phosphide does not layer, but expands to fill the available space. ***Symptoms of poisoning:*** Severity is dependent on concentration of hydrogen phosphide involved. Mild poisoning results in fatigue, nausea, pressure or pain in the chest, ringing in the ears, and uneasiness. Hydrogen phosphide is not a chronic poison, and these symptoms will readily disappear with rest and fresh air. Greater quantities of gas produce such symptoms as vomiting, stomachache, diarrhea, disturbance in equilibrium, and dyspnea (difficulty in breathing). Very high concentrations quickly cause bluish-purple skin colour, agitation, poor muscle co-ordination, sub-normal blood oxygen content, unconsciousness and death. Death can occur very quickly, or be delayed several days as a result of pulmonary edema and collapse, by paralysis of the central respiratory system. In cases of severe poisoning, disturbance in liver and kidney function can also occur. ***First Aid:*** Should exposure to hydrogen phosphide be documented or suspected - remove patient from gas atmosphere to open air. CALL A PHYSICIAN IMMEDIATELY. Have patient lay down, keeping him warm and comfortable. Treat as for shock. Make NO antidotal use of fats, oil, butter, or milk. Do NOT administer atropine as it is contraindicative. Commence artificial respiration if breathing has ceased. When exposure to low concentrations of hydrogen phosphide have been documented or suspected, the individual involved should rest for 24 hours and under no circumstances should he resume any work dealing with fumigation.

13. STORAGE: Tablets and pellets are received in wooden cases containing sealed tubes and cans, or resealable flasks. As long as the tubes, cans or flasks remain intact, the storage life of the product is unlimited. Storage should be in a dry, locked, ventilated area and out of the reach of children and irresponsible persons.

GUTHION (azinphos-methyl)

Chemagro

1. FORMULATIONS: Spray Concentrate (SC); 240 g/L; 20 L pail. Wettable Powder (WP); 50%;
2. REGISTERED MIXES: None. ***Mixing Instructions:*** Wettable Powder - mix the required amount with a small quantity of water. Add this pre-mix through the screen while filling the sprayer tank or fill the tank to the required level and then add the pre-mix. Operate the agitator while mixing. Spray Concentrate - pour the required amount into full amount of water and then agitate.
3. CROPS: Alfalfa, barley, canola, clover, oats, potatoes, rye, sugar beets, wheat.
4. INSECTS CONTROLLED:

alfalfa plant bug	diamondback moth	lygus bugs	sweet clover weevil
alfalfa weevil	flea beetles	mites	tarnished plant bug
aphids	grasshoppers	red turnip beetle	
Colorado potato beetle	leafhoppers	spittle bug	

5. WHEN USED: One per season on barley, oats, rye, sugar beets, wheat. One per season on alfalfa and clover except 2 per season for sweet clover weevil control or when using rates of 910 mL SC/ac or less. Repeat as necessary on canola and potatoes. Red turnip beetle - repeat as necessary.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: lower rate on immature insects, light infestations or sparse foliage.

Crop	Insect	Liquid Qty/ac	Powder Qty/ac
Alfalfa, clover.	Alfalfa plant bug, alfalfa weevil, aphids, leafhoppers, lygus bugs, mites, spittle bugs.	0.9-1.4 L	445-710 g
	Grasshoppers	0.425-0.7 L	-
	Sweet clover weevil	910 mL	445 g
Canola	Diamondback moth	225-505 mL	110-225 g
	Flea beetles	110-225 mL	60-110 g
Canola	Red turnip beetle	225-345 mL	110-170 g
Barley, oats, rye, wheat.	Grasshoppers	0.425-0.7 L	-
Potato	Aphids	1.4 L	710 g
	Colorado potato beetle	510-710 mL	225-345 g
Potato	Flea beetle, leafhoppers, spittle bug, tarnished plant bug.	0.9-1.4 L	445-710 g
Sugar beets	Flea beetles	110 mL	60 g

   Water Volume: Air - 16 L/ac minimum. Ground - 32 L/ac minimum. Alfalfa weevil - 60-80 L/ac on heavy growth.
   Nozzles: When spraying canola and sugar beets, wettable powder may be applied using any commercial tractor, or drawn or self-propelled field sprayer provided it is equipped with the following: • nozzle tips no finer than 6502, 8002 or TK2 with nozzle screens no finer than 50 mesh. These tips will provide 40 L/ac when operated at 8 km/hr and 200 kPa. • 50 mesh or larger line strainers or screens. Note that felt filters, smaller nozzle tips or smaller screens will become clogged when using the wettable powder formulation.
7. APPLICATION TIPS: • For red turnip beetle, spray an 18-30 m wide band around the field or where beetles are causing damage. • The spray concentrate forms an emulsion when diluted with water and is suitable for use in all power-operated ground sprayers and aircraft sprayers. • Do not apply when crop is in bloom or allow spray to drift towards beehives. • Do not use on greenhouse food crops or other crops used for food or forage. • Use only according to label directions. Application at rates above those shown may result in illegal crop residues.
8. HOW IT WORKS: Azinphos-methyl is a contact, non-systemic, organophosphate insecticide and acaricide.
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest or pre-grazing interval (days): alfalfa, clover (21); canola, cereals (30); potatoes (7); sugar beets (100).
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (11). Highly toxic to bees exposed to direct treatment or residues on crops. Poisonous if swallowed, inhaled, or absorbed through the skin.

11. PRECAUTIONS, FIRST AID: Do not get in eyes or on skin. Wear protective clothing, natural rubber gloves, and goggles. Do not breathe dust or spray mist. Wear a pesticide respirator. Keep all unprotected persons out of the operating area or vicinity where there may be danger of drift. Workers who must enter treated fields within 2 days of application should wear protective clothing. Wash hands, arms, and face thoroughly with soap and warm water before eating or smoking. Wash all contaminated clothes with soap and hot water before reuse. KEEP OUT OF REACH OF CHILDREN. DO NOT CONTAMINATE FEED OR FOOD. ***Symptoms of poisoning:*** tightness in the chest, sweating, contracted pupils, stomach pains, vomiting and diarrhea. ***First Aid:*** CALL A PHYSICIAN IMMEDIATELY. Have patient lie down and keep quiet. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Repeat until vomit fluid is clear. The patient should be lying down with the head below the foot level and facing down or to the side.
FOR PHYSICIAN: Compound inhibits cholinesterase, resulting in stimulation of the central nervous system, the parasympathetic nervous system, and the somatic motor nerves. Do NOT give morphine. Watch for pulmonary edema which may develop in serious cases of poisoning even after 12 hours. At first sign of pulmonary edema, the patient should be placed in an oxygen tent and treated symptomatically. **Antidote is atropine sulphate** in large therapeutic doses. Repeat as necessary to the point of tolerance. 2-PAM is also antidotal and may be administered in conjunction with atropine

12. STORAGE: Do not store spray concentrate below -4°C. Protect products from heat and open flame. Do not heat.

LANNATE L(methomyl)

DuPont

1. FORMULATIONS: Water Soluble Liquid; Lannate L; 215 g/L; 10 L jug.

2. REGISTERED MIXES: ***Mixing Instructions:*** Add 1/4-1/2 required amount of water. Add Lannate L directly to tank, mix thoroughly. Once dissolved, continued agitation is not required. Do not use air agitation.

3. CROPS: Barley, canola, corn (sweet), flax, oats, potatoes, wheat.

4. INSECTS CONTROLLED:

alfalfa lopper	beet webworm	European corn borer	leafhopper
aphids	corn earworm	flax bollworm	thrips
armyworm (bertha, common)	cutworm (clover, variegated)	flea beetle	

5. WHEN USED: when insects appear; applications at 5-7 days intervals or as needed No restriction on number of applications. Early morning or late evening sprays are recommended. ***Corn earworm:*** spray whorls as needed and silks at 2-4 days intervals or as needed. ***European corn borer:*** (Consult your district agriculturist). At 3-5 day intervals or as needed. Second brood; spray whorls before tassels appear, continue through early silk.

6. HOW TO APPLY:
With: Aircraft (barley, canola, flax, oats, wheat) or Ground equipment (all crops).
Rate: low rate only for very young insects, small plants, or light infestations.

Crop	Insect	L/ac	Crop	Insect	L/ac
Barley, oats, wheat.	Common armyworm	0.5-0.9	Corn, sweet	Corn earworm	0.8-1.1
	Thrips	0.5		European corn borer	1.1
Canola	Alfalfa looper, bertha armyworm, beet webworm, clover cutworm.	0.4-0.5	Flax	Bertha armyworm, flax bollworm.	0.4-0.5
	Variegated cutworm	0.5-0.9	Potato	Aphids, flea beetles, leafhoppers.	0.9

Water Volume: Air - 16 L/ac minimum. Ground - 20-60 L/ac.

7. APPLICATION TIPS: • Apply at the recommended rates in sufficient water to obtain thorough, uniform coverage. • Best control is obtained when spray schedules are initiated on young insects. • To control severe infestations, use 1-3 applications of the highest recommended rate then use the lowest rate possible to maintain control. • Use only in commercial plantings; do not use in home plantings.

8. HOW IT WORKS: A carbamate insecticide which works by contact and ingestion and has some systemic action. Rapidly degraded in green, growing plants; short-term residual. Rapid knock-down.

9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): Barley, oats, wheat (20); Canola, flax (8); Corn (sweet), potatoes (3).

10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (17). Toxic to bees. May be fatal or cause blindness if swallowed. Poisonous if inhaled. Causes eye damage.

11. PRECAUTIONS, FIRST AID: Do not get in eyes or on clothing. Wear goggles, boots, gloves, and respirator (Willson Agri-Tox R-533 Model A-Tx-2, Filter R15, Cartridge R21; or Mine Safety "Comfo" 2). Extremely flammable; keep away from heat, sparks, and open flame. Do not breathe vapors or spray mist. Use in an adequately ventilated area. Aircraft pilot should not assist in the mixing and loading operation. Apply when bees are not foraging. ***Symptoms of poisoning:*** weakness, blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse, or muscle tremors. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). MEDICAL ATTENTION IS NECESSARY IN ALL CASES. **Atropine is an antidote.** Consult physician for an emergency supply of 1/100 grain atropine tablets. If symptoms appear before a physician arrives, immediately swallow 2 atropine tablets (each 1/65 mg); thereafter, every 10-15 minutes, take 1 atropine tablet until the throat becomes dry and the skin becomes dry and flushed. Take additional tablets as necessary. ***For Physician:*** Administer atropine sulphate in repeated doses, 1.2-2.0 mg intravenously every 10-30 minutes until full atropinization is achieved. Maintain atropinization until patient recovers. Do NOT use morphine. 2-PAM may be used to supplement atropine treatment.

12. STORAGE: Do not store below 0°C. Above 136°C, product decomposes and may explode if confined. Keep away from heat, sparks, and open flame.

LINDANE (gamma BHC)

Pfizer

1. FORMULATIONS: Wettable Powder; Lindane 25W; 25%; 1 kg bag.
2. REGISTERED MIXES: Most commercial formulations of lindane for seed treatment are mixed with 1, 2 or 3 fungicides (any of: benomyl, captan, carbathiin, maneb, TCMTB, thiram). The insecticide diazinon is added to some. (see page 139).
3. CROPS: Barley, beans, corn, oats, peas, rye, sugar beets, wheat.
4. INSECTS CONTROLLED: Wireworms
5. WHEN USED: Pre-seeding treatment for seed or soil treatment.
6. HOW TO APPLY:
   With: ***Seed Treatment:*** by Kemp Seed Treater, home-made rotary drum treater, or any seed treatment equipment that will ensure uniform coverage of seed.
   Rate:

Crop	Insect	Quantity (g/25 kg seed)
Barley, corn.	Wireworms	55
Beans, peas.		50
Oats		75
Rye		45
Sugar beets		165
Wheat		40

7. APPLICATION TIPS: Do NOT mix with hands.
8. HOW IT WORKS: Lindane is an organochlorine insecticide which works by ingestion and contact.
9. GRAZING AND HARVEST RESTRICTIONS: Do not use treated seed for feed, food or oil processing. Do not graze or feed livestock on treated areas for 4 weeks after planting.
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (88-270). Lindane is toxic to fish, birds, and other wildlife.
11. PRECAUTIONS, FIRST AID: Read the label before using any product. Wear protective gear to avoid contact with skin or eyes. Do not inhale dust or spray. Work in a well ventilated area. Change clothes daily. If treated seed is to be stored label as ***"Do not use for food or feed. This seed has been treated with lindane. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** nausea, vomiting, hyperirritability, convulsions, and coma. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately. ***For Physician:*** Lindane is an organochlorine insecticide. Barbiturates may be given to control convulsions. Oxygen may be indicated. Keep patient quiet. Avoid use of morphine and adrenaline.
12. STORAGE: Do not store in the home, or near food or feed.

LORSBAN 4E (chlorpyrifos)

Dow

DANGER POISON

1. FORMULATIONS: Emulsifiable Concentrate; 480 g/L; 10 L jugs.
2. REGISTERED MIXES: None. ***Mix Restrictions:*** Do not add any additional adjuvants, surfactants, or spreader stickers.
3. CROPS: Barley, canola, corn (field, sweet), flax, oats, potatoes, sugar beets, sunflowers, wheat.
4. INSECTS CONTROLLED:

alfalfa looper	cutworms (army, black,	diamondback moth larvae	tarnished plant bug
armyworm (bertha, common)	dark-sided, pale western,	grasshoppers	wheat midge
Colorado potato beetle	red-backed, variegated)	potato flea beetle	

5. WHEN USED: When damage first appears. ***Canola pests:*** when infestations are heavy enough to cause losses. ***Wheat midge:*** - when adults are found in crop (1 midge/4-5 wheat heads). When 25% of wheat head has emerged from boot, but preferably delayed until flowering. (in 30% of crop). ***Number of applications:*** 1/season as • a foliage treatment of barley, canola, oats, or wheat; • a seedling or soil treatment of potatoes; • a seedling treatment of canola, flax, sugar beet, sunflower. Maximum of 9 weekly applications on potato foliage.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: lower rate for young insects, light infestations or sparse foliage.

Crop	Stage	Insect	mL/ac
Canola, flax.	seedling	Cutworms (army, dark-sided, pale western, red-backed, variegated).	350-485
Corn (field, sweet), potatoes.	seedling	Cutworms (black, dark-sided, red-backed).	485-970
Sugar beets	seedling	Cutworms (pale western, red-backed).	485-970
Sunflower	seedling	Cutworms (army, pale western, red-backed).	485
Barley, oats, wheat.	foliage	Armyworm (bertha, common), cutworms (army, dark-sided, pale western, red-backed)	350-485
		Grasshoppers (young)	235
		Grasshoppers (all stages)	355
		Wheatmidge	325
Canola	foliage	Alfalfa looper, armyworm (bertha, common).	305-405
		Diamondback moth (larva)	405-605
		Grasshoppers	235-355
Potatoes	foliage	Colorado potato beetle, potato flea beetle, tarnished plant bug.	405

   Water Volume: Air - ***Foliage*** Barley, oats, wheat: 5-20 L/ac. Canola: 4 L/ac. ***Seedlings*** Canola, flax: 4-8 L/ac. Ground - ***Foliage*** Barley, canola, oats, wheat (grasshoppers) 40-80 L/ac. Barley, oats, wheat (armyworms, cutworms, wheat midge) 20-80 L/ac. Canola (other than grasshoppers) 16 L/ac. ***Seedlings*** Canola, flax, sugar beets, sunflower: 32-80 L/ac. Corn, potatoes: 80-160 L/ac.
7. APPLICATION TIPS: ***Cutworms:*** Use the higher rates when the top 1 cm of soil surface is extremely dry or when the infestation is heavy. ***Foliage treatments:*** when spraying crops near maturity, an application system that gives maximum penetration of the crop canopy is necessary to get good insect kill. Do not apply to crops in bloom.
8. HOW IT WORKS: A broad-spectrum, non-systemic insecticide. Works by contact, ingestion and vapour action.
9. EXPECTED RESULTS: Insects must come in direct contact with the insecticide in order to be affected. Degrades on foliage by weathering, and a significant kill of insects eating treated foliage may not last beyond 48 hours after treatment. Somewhat more persistent in soil and control of soil-borne insects may be more durable.
10. EFFECTS OF RAINFALL: ***Foliar treatments*** should be made 4-6 hours before forecasted rainfall. ***Soil treatment*** before forecasted heavy rainfall should be avoided. A light rainfall during or after application is probably helpful.
11. MOVEMENT IN SOIL: Binds to organic matter in soil, and is not likely to leach in soils with some organic matter.
12. GRAZING AND HARVEST RESTRICTIONS: Wait-interval for canola is counted from day of processing. Pre-harvest interval (days) - ***Foliage:*** barley, oat, wheat (60); canola (21); potato (7). ***Seedling:*** canola, flax (21); corn, potatoes (70); sugar beets, sunflowers (90). Cover crop treated with Lorsban should not be used for human or animal consumption.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (135-163). Toxic to bees and fish.
14. PRECAUTIONS, FIRST AID: Wear protective gear to avoid contact with skin or eyes. Do not inhale vapours or spray mist. Keep away from heat, sparks, and open flame. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning by inhalation:*** stuffy, runny nose, scratchy throat, asthmatic wheezing, sudden bronchospasm, swelling of oral and laryngeal mucous membranes, shock. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - do NOT induce vomiting. Get medical attention immediately. ***For Physician:*** contains a cholinesterase inhibitor and a solvent. **Antidote is atropine.**
15. STORAGE: Combustible liquid; keep away from heat, sparks, and open flame.

MALATHION, CYTHION (malathion)

Chipman/Cyanamid/May & Baker/Pfizer

1. FORMULATIONS: Emulsifiable Concentrates - Malathion (500, 50EC, 5E), Cythion; 500 g/L; 4 X 4 L, 20 L can. Liquid - Cythion Liquid Grain Protectant; 1 kg/L; 4 X 4 pack. Dust - 2% Malathion; 2%; 22.7 kg bag. Grain Protectant; 0.5%; 20 kg bag.

2. REGISTERED MIXES: Mexthoxychlor

3. CROPS: Alfalfa, barley, canola, clover, corn, flax, mustard, oats, pasture, potatoes, rye, sugar beets, sweet clover, wheat.

4. INSECTS CONTROLLED:

Foliar Spray

alfalfa weevil larvae	corn earworm	greenbugs	sweet clover weevils
aphids	English grain aphid	leafhoppers	winter grain mites
army worms	European corn borer	lygus bugs	
Colorado potato beetles	flea beetles	spider mites	
diamondback moth larvae	grasshoppers	spittle bugs (adults)	

Grain Protectant

grain beetles (flat, rusty, saw-toothed)	grain mites flour beetles (confused, red)	Indian meal moths lesser grain borers	weevils (granary, rice)

5. WHEN USED: ***Foliar Spray:*** Legumes - when 75% of foliage shows feeding damage. Do not apply to legumes in bloom. Sweet clover - spray field margins of first year clover in late summer or early fall when migration of weevil adults is occurring. Canola, Flax - when bees are absent from field and temperatures is above 18°C. Sugar Beets - at 3-5 leaf stage when insects or damage first appears. ***Grain Protectant:*** as grain is being loaded or turned into final storage. Surface protectant - immediately after grain is loaded into storage.

6. HOW TO APPLY:

(A) Emulsifiable Concentrates

With: Aircraft or Ground equipment.

Rate: lower rate for immature insects, light infestations or sparse foliage.

Crop	Insect	L/ac
Alfalfa	Alfalfa weevil larvae, lygus bugs, spittle bugs adults.	0.9-1.1
Alfalfa, clover.	Aphids, grasshoppers, leafhoppers, spider mites.	0.9-1.1
Canola, mustard.	Flea beetles	0.4-0.7
	Diamondback moth larvae	0.2-0.3
Canola, mustard, flax, pastures.	Grasshoppers	0.4-1.1
Cereals	Armyworms, English grain aphid, greenbugs, winter grain mites.	0.4-1.1
Cereals, hay.	Grasshoppers	0.7
Potatoes	Aphids, Colorado potato beetle, leafhoppers, spider mites.	0.6-0.9
Sugar beets	Flea beetles	0.4
Sweet clover	Sweet clover weevil	0.6-1.0

Water Volume: Potato pests - 400 L/ac.

(B) Grain Protectants

With: Spray or Dust applicators.

Rate: NOTE: Treated grain should not be offered for sale until 7 days after treatment.

Insect	Grain	Liquid mL/1000 kg grain	Dusts g/1000 kg grain	
			0.5%	2.0%
Grain beetles (flat, rusty, saw-toothed); grain mites; lesser grain bores; flour beetles (confused, red); weevils (granary, rice); Indian meal moth.	Barley	12	2000	520
	Corn	10	-	-
	Oats	17	3000	735
	Rye	10	1750	450
	Wheat	10	1750	415
Indian meal moth	Barley, corn, oats, rye, wheat.	300 mL/100 m² of grain surface	-	-

Water Volume: 10-20 L water; Indian meal moth (surface treatment) 5-10 L water
Incorporation: Add to grain as it is being augered, or scatter proper amount of dust on each load and cut in with shovel before dumping.

7. APPLICATION TIPS: ***All crops:*** Apply when day temperature is expected to exceed 20°C. ***Stored Grain:*** to protect from Indian meal moth, spray evenly over the surface of clean or uninfested grain and rake to a depth of 15 cm. Where special application equipment is not available, any type of low pressure sprayer holding 5 L or more can be used. Apply spray to the grain stream as it is being elevated into storage. Test sprayer calibration by discharging into a tank of water, then regulate flow of grain to get the proper rate of spray. Keep spray coarse to avoid loss as "drift". ***Before storing new grain:*** thoroughly clean up old grain and debris from bins, elevators, or grain handling equipment. Remove and burn all sweepings. After cleaning the premises, apply a residual malathion spray to walls, floors and machinery in grain elevators or farm storage, using 200 mL Grain Protectant/5 L water. Force spray into cracks and crevices. Apply at 5 L of spray/100 m^2 of surface area using a coarse wetting spray. Wait until spray has thoroughly dried before storing grain in treated areas. Spray this mixture around the outside of bins and elevators to help prevent re-infestation.
8. HOW IT WORKS: A non-systemic, contact, organophosphate insecticide and acaricide of brief to moderate persistence. Generally non-phytotoxic. Not effective below 20°C (does not apply for control of stored grain insects).
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest and pre-grazing intervals (days): canola (7), cereals (7), flax (7), hay (7), legumes (7), mustard (7), pastures (0), potatoes (3). ***Forages and pasture:*** remove cattle before spraying; cattle may be returned immediately after spraying.
10. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (2,600). Highly toxic to bees and fish.
11. PRECAUTIONS, FIRST AID: Wear protective gear to avoid contact with skin or eyes - do not inhale vapour, spray mist or dust. Do not apply to plants in bloom. ***Symptoms of poisoning:*** headache, weakness, sweating, giddiness, blurred vision, nausea, abdominal cramps, diarrhea, and discomfort in chest. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
12. STORAGE: Do not store near food or feed. Keep container tightly sealed when not being used.
13. DECONTAMINATION AND DISPOSAL: Malathion breaks down rapidly in the presence of water and alkaline materials. Containers and spillages can be readily decontaminated by use of Javex or lye, or washing soaps containing sodium hydroxide.

MONITOR (methamidophos)

Chemagro

1. FORMULATIONS: Liquid; 480 g/L; 10 L pail.
2. REGISTERED MIXES: Compatible with most commonly used fungicides.
3. CROPS: Canola, potatoes.
4. INSECTS CONTROLLED:

aphids	Colorado potato beetle	potato flea beetle	potato leafhopper
bertha armyworm	grasshoppers		

5. WHEN USED: ***Canola*** - bertha armyworm; when small larvae are present or when damage first appears; 2 applications per season. ***Grasshoppers*** - when migration of grasshoppers from ditches and field borders become apparent; 2 applications per season. ***Potatoes*** - apply in a 10-14 day program or as necessary.
6. HOW TO APPLY:

With: Aircraft or Ground equipment.

Rate: higher rate for severe infestations, adult insects, or dense foliage.

Crop	Insect	mL/ac
Canola	Bertha armyworm	230-500
	Grasshoppers	500
Potato	Aphids, Colorado potato beetle, potato flea beetle, potato leafhopper.	710-910

Water Volume: Air (canola) - 4 L/ac minimum. Ground - 80-400 L/ac.

7. APPLICATION TIPS: Avoid use during flowering and pollination periods.
8. HOW IT WORKS: Methamidophos is a broad spectrum organophosphorus insecticide and acaricide which works by contact and systemic action. Non-phytotoxic when used as directed. Contact effectiveness may persist for 7-21 days.
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): canola (10), potatoes (14).
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (30). Extremely toxic to wildlife. Highly toxic to bees exposed to direct treatment or residues on crops.
11. PRECAUTIONS, FIRST AID: Do not inhale vapours or spray mist. Wear a protective respirator suitable for protection against organophosphorous insecticides. Wear standard protective clothing (see page 4), rubber gloves, and goggles. Keep unprotected personnel out of mixing and spray area. DO NOT APPLY under conditions involving possible drift to food, forage or other planting that might be damaged or the crops thereof rendered unfit for sale, use or consumption. ***Symptoms of poisoning:*** tightness in the chest, sweating, contracted pupils, stomach pains, vomiting and diarrhea. ***First Aid:*** In case of poisoning get medical attention immediately. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Repeat until vomit fluid is clear. Patient should be lying down with head below the foot level and turned to the side. ***For Physician:*** Antidote is atropine sulphate administered in large therapeutic doses repeated as necessary to the point of tolerance. 2-PAM is also antidotal and may be administered in conjuction with atropine. Do NOT give morphine.
12. STORAGE: Store and display apart from food or feed. Do not store in or around the home. Store in a cool, dry place but not below -10°C. Protect from heat.

PIRIMOR (pirimicarb)

Chipman

1. FORMULATIONS: Wettable Powder; 50%; 1 kg, 20 kg bags.
2. REGISTERED MIXES: Compatible with thuricide HPC, Dipel, Sevin.
3. CROPS: Corn (sweet), peas, potatoes.
4. INSECTS CONTROLLED: Aphids on corn, buckthorn aphid, green peach aphid, pea aphid.
5. WHEN USED: Potatoes - repeat applications as required to maintain control. Corn - make 1 application only.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: higher rate when aphid populations are high or under very cool weather conditions.

Crop	Insect	g/ac
Corn, sweet	Aphids	222
Peas	Pea aphid	61-111
Potatoes	Green peach aphid, buckthorn aphid.	172-222

   Water Volume: Peas - 7 L/ac minimum for aircraft. Potatoes - 200-400 L/ac.
7. APPLICATION TIPS: Apply in enough water to ensure thorough coverage of all foliage.
8. HOW IT WORKS: Works by contact, vapour and local systemic action. Is specific to aphids and fits into integrated control programs.
9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): potatoes (7), peas (6), corn (3).
10. TOXICITY: High acute mammalian toxicity. Oral LD_{50} rats (mg/kg) = (147). Low toxicity to fish.
11. PRECAUTIONS, FIRST AID: Avoid breathing dust or spray mist. Avoid contact with skin and eyes. Wear standard protective clothing (see page 4), gloves, overalls and eye protection. Wash hands and exposed skin before meals and after work. Change contaminated clothing daily. ***Symptoms of poisoning:*** blurred vision and/or breathing difficulties. If symptoms occur, move out of sprayed area and call a doctor. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention. ***For Physician:*** Pirimor is a moderate, reversible cholinesterase inhibitor. **Atropine is antidotal,** at 1-4 mg by intramuscular injection, followed by a further 2 mg every 30 minutes as necessary. P2S and 2-PAM are not effective.
12. STORAGE: Store in original container in dry place.

SEVIN (carbaryl)

Union Carbide/Chipman

1. FORMULATIONS: Liquid Suspensions; XLR, XLR-Plus; 480 g/L; 10 L jug. Chipman Sevin; 420 g/L; 4 L, 20 L can. Wettable Powder; 50W; 50%; 2 kg bag. Sprayable Powder; 80S; 80%; 4.5 kg bag.

2. REGISTERED MIXES: Most formulations are compatible with a wide range of pesticides. Do NOT apply mixes if they are physically incompatible (e.g. curdle or precipitate). Liquid formulations are NOT compatible with diesel fuel, kerosene, fuel oil, aromatic solvents, or any Stampede formulation. All formulations are unstable when mixed with alkaline materials such as Bordeaux mixture, lime-sulphur and casein-lime spreaders. ***Mixing Instructions:*** Prepare only the required amount of spray on the day of application. Do not store spray mixtures overnight. Agitate, stir, or recirculate all carbaryl sprays prior to use.

3. CROPS:

alfalfa	clover	non-crop areas	potato	wheat
barley	corn (field, sweet)	oats	rangelands	
canola	forages grasses	pastures	rye	

4. INSECTS CONTROLLED:

alfalfa caterpillar	Colorado potato beetle	flea beetles	sweet clover weevil
alfalfa weevil larvae	corn earworm	grasshoppers	tarnished plant bug
armyworm	corn rootworm adults	leafhoppers	webworms
blister beetles	European corn borer	potato flea beetles	
climbing cutworms	fall armyworm	stink bugs	

5. WHEN USED: Apply when insects or their damage appears. Repeat as necessary.

6. HOW TO APPLY:

With: Aircraft or Ground equipment. Clean lines and tank after spraying.

Rate: lower rate on immature insects, light infestations, or sparse foliage; higher rate for adult insects, severe infestations, or dense foliage.

Crop	Insect	XLR/XLR-Plus L/ac	50 W kg/ac	80 S kg/ac	Chipman L/ac
Canola (seedlings only, up to 4 weeks after emergence)	Flea beetles	0.2	-	0.3	
	Grasshoppers	0.50-1.0, nymph			
	Grasshoppers	1.0-1.4, adult			
Barley, oats, rye, wheat.	Grasshoppers	0.5-1.0, nymph 1.0-1.4, adult	0.45-0.9	0.3-0.6	0.6-1.1
	Blister beetles	1.0-1.6	0.9-1.3	0.6-0.7	1.1-1.7
Alfalfa, clover.	Alfalfa caterpillar, armyworm, webworms.	1.0-2.1	0.9-1.8	0.7-0.9	1.1-2.2
	Alfalfa weevil larvae	-	1.3	0.9	-
	Climbing cutworms	-	0.9-1.8	0.6-1.2	-
	Blister beetles, flea beetles, leafhoppers.	1.0-1.6	0.9-1.3	0.6-0.7	1.1-1.7
Corn (field, sweet)	Corn earworm, European corn borer, fall armyworm.	1.0-1.6	0.9-1.3	0.6-0.9	1.1-1.6
	Climbing cutworms	2.1	42.5 g/100 m row	1.2	-
	Grasshoppers	0.5-1.0, nymph	-	-	-
		1.0-1.4, adult	-	-	-
Potato	Colorado potato beetle	0.5	0.45	-	0.6
	Leafhoppers	0.5	0.9	0.6	1.1
	Potato flea beetle	0.5	0.9	0.3-0.6	1.1
Forage grasses, pastures, rangeland, non-crop areas.	Grasshoppers (nymphs or sparse vegetation)	0.5-1.0	-	-	-
	Grasshoppers (adults or dense vegetation)	1.0-1.4	-	-	-

Water Volume: Aircraft - 4 L/ac minimum. Ground - 12 L/ac minimum. ***XLR:*** 1:1 (XLR:water) for maximum wash off resistance. Dilutions greater than 1:11 will reduce wash off resistance. Climbing cutworms - 91-111 L/ac. ***XLR-Plus:*** Dilutions greater than 1:39 will reduce wash off resistance. ***50W:*** Aircraft - 4-14 L/ac; Ground - 11-14 L/ac. Climbing cutworms: Corn - 89-142 L/ac; Forages, cereals - 229 L/ac minimum; Potato - 91-111 L/ac. ***80S:*** Corn, potatoes - use sufficient water to obtain full coverage; Climbing cutworms - 89-111 L/ac. Forages, cereals - 22-178 L/ac; Climbing cutworms 223 L/ac minimum. ***Chipman Sevin:*** Aircraft - 4 L/ac; Ground - 12 L/ac minimum. ***All Crops:*** Use sufficient water to obtain thorough and uniform coverage of spray depending on equipment, severity of infestation and stage of crop growth. ***Low volume air applications:*** hot, dry conditions may cause excessive evaporation of droplets. A higher spray volume per acre may be required under hot, dry conditions and when crop canopies are particularly dense.

Nozzles: Low volume applications: ***Wettable Powder:*** 50-mesh or coarser screens in entire system; cone type nozzles, No. 3 or larger. ***XLR/XLR-Plus:*** 50-mesh, in-line strainers and 25-mesh, slotted strainers behind the nozzle; cone type nozzles, sizes D6-45 or D8-45. ***Chipman Sevin:*** finer than 50 mesh screen. **NOTE:** Flat fan nozzles may be used but care should be

taken as excessive droplet breakup and resulting production of fine droplets may occur. Flat fan nozzles are also prone to plugging under hot, dry conditions.

7. APPLICATION TIPS: • Timing and good coverage are essential for effective control. Calibrate spray equipment to deliver the required volume. • Agitate, stir or recirculate all carbaryl formulations prior to use. ***Corn:*** Treat entire plant for larvae in whorls or foliage feeders. Spray in 25-30 cm band over the row for climbing cutworms. Apply at 2-4 day intervals, if necessary, for insects attacking silks and ears; start when first silks appear and continue until silks begin to dry (3 or more applications may be needed). ***Alfalfa Weevil:*** If pre-treatment damage is extensive, cut and make application to stubble.

8. HOW IT WORKS: A carbamate insecticide which works by contact and ingestion. Moderate to rapid in speed of action with short to moderate residual effectiveness (2 days to 4 weeks) depending on crop/pest complex, formulation and climatic conditions.

9. EXPECTED RESULTS: Some immediate control is expected but the majority of control occurs 24-48 hours after application.

10. EFFECTS OF RAINFALL: Do not apply just before rain. ***XLR:*** under low humidity, at least 1 hour drying is adequate. Spray must dry on foliage to have wash off resistance. Maximum resistance to wash off is obtained with a 1:1 (XLR:Water) dilution. ***XLR-Plus:*** Maximum resistance to wash off is obtained in the range of 1:1-1:39 (XLR-Plus:Water) dilution. ***50W/80S:*** Do not apply to wet foliage or when rain or high humidity is expected during the next 2 days. ***Chipman Sevin:*** Plant injury may occur on tender foliage when prolonged misty rain or high humidity follows spraying.

11. MOVEMENT IN SOIL: None.

12. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest or pre-grazing interval (days): Barley, oats, rye, wheat (14); corn (1); potatoes (7). Alfalfa, clovers, forage grasses, pasture, rangeland, non-crop areas (0). Remove cattle from area to be sprayed. Cattle may graze immediately after application. Treated forage and feed crops may be fed to dairy animals and animals for slaughter provided sprays are applied as directed.

13. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (540). Although carbaryl is toxic to honey bees, Sevin XLR and XLR-Plus have a reduced honey bee hazard warning; do not apply directly to foraging bees.

14. PRECAUTIONS, FIRST AID: Wear protective gear to avoid contact with skin and eyes - do not inhale spray mist. Except for the XLR formulation, carbaryl should not be applied to crops in bloom. XLR can be applied when bees are not foraging provided the residue on the plants is dry before foraging commmences. ***Symptoms of poisoning:*** salivation, tearing, urination, defication, pinpoint pupils, muscle spasms, general muscular weakness, nausea, prostration, convulsions. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention immediately. IN EMERGENCY, phone collect (24 hours a day) 1-(514)645-5311. ***For Physician:*** Carbaryl insecticide is a moderate, reversible, cholinesterase inhibitor. **Atropine is antidotal.** Do not use 2-PAM opiates, or cholinesterase inhibiting drugs.

15. STORAGE: Do not store where temperature frequently exceeds 38°C. All formulations will withstand freezing.

SUPRACIDE (methidathion)

Ciba-Geigy

1. FORMULATIONS: Emulsifiable Concentrate; 240 g/L; 2 X 10 L containers.
2. REGISTERED MIXES: None. Supracide is compatible with many fungicides.
3. CROPS: Alfalfa, canola, mustard, potato, sunflower.
4. INSECTS CONTROLLED:

alfalfa weevil	leafhopper	potato leafhopper	sunflower maggot
Colorado potato beetle	lygus bugs	red turnip beetle	sunflower moth
diamondback moth	painted lady butterfly	sunflower beetle	tarnished plant bug
flea beetles	pea aphid		

5. WHEN USED: ***Alfalfa:*** alfalfa weevil - when insects or damage first appears, or when 20-30% of stems have tip damage. Leafhoppers, lygus bugs, pea aphid - during pinhole stages of damage. ***Canola/Mustard:*** Diamondback moth, turnip beetle - when insects are small and damage first appears. ***Potato:*** Colorado potato beetles, tarnished plant bugs, potato leafhopper - when insects first appear; repeat as necessary at 7 day intervals, except flea beetle, potato beetle at 10-15 day intervals. ***Sunflowers:*** when insects and damage first appears.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: higher rate for severe infestations, adult insects, or dense foliage.

Crop	Insect	L/ac
Alfalfa	Alfalfa weevil, leafhoppers, lygus bugs, pea aphid.	0.5-0.9
Canola, mustard.	Flea beetles	0.3
	Diamondback moth, red turnip beetle.	0.4
Potato	Flea beetles	0.3
	Colorado potato beetle, flea beetles.	0.4
	Flea beetles, leafhoppers, tarnished plant bug.	0.5
Sunflower	Painted lady butterfly, sunflower maggot, sunflower moth.	0.9-1.2
	Sunflower beetle	0.4-0.9

   Water Volume: Air - 9 L/ac, Potatoes - 4.5-9.0 L/ac. Ground - 45 L/ac.
7. APPLICATION TIPS: • To reduce injury to bees, restrict time of application to after dark or in the early morning. Do not apply during full bloom of alfalfa. • Repeated applications to potatoes may lead to excessive aphid populations, apply only when required. • Coverage of sunflower heads is essential.
8. HOW IT WORKS: A non-systemic organophosphate insecticide. Works by contact and ingestion.
9. EFFECTS OF RAINFALL: Do not apply when rain is imminent. Do not apply where runoff is likely to occur.
10. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): alfalfa (10), canola (30), potatoes (14), sunflowers (50). Do not harvest alfalfa for feed or hay or allow livestock to graze within 10 days of application. Do not feed or allow livestock to graze on treated canola, mustard or sunflower.
11. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (65). Toxic to bees, fish, birds, and other wildlife.
12. PRECAUTIONS, FIRST AID: Do not get in eyes, on skin or clothing. Wear goggles or face shield and rubber gloves when mixing. Do not inhale spray mist. Wear a respirator during prolonged use. Change clothing daily. Do not re-enter the treated field on day of application. A minimum 3 day re-entry period for foraging bees is necessary. ***Symptoms of poisoning:*** Headache, dizziness, blurred vision, weakness, nausea, cramps, diarrhea, discomfort in chest, sweating, salivation, pulmonary edema, cyanosis, uncontrollable muscle twitches, loss of reflexes, convulsions, coma. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately. ***For Physician:*** Atropine is antidotal.
13. STORAGE: Store at temperatures above 0°C. Do not use or store near heat or open flame.

TEMIK (aldicarb)
Union Carbide

1. FORMULATIONS: Granular; Temik 10G; 10%; 15 kg bag.
2. MARKETING CATEGORY: Restricted use; contact local pesticide regulatory authorities about use permits which may be required. To be stored and displayed apart from food and feed.
3. REGISTERED MIXES: Compatible with most fertilizers and pesticides. Do not use with alkaline materials such as lime.
4. CROPS: Potatoes, sugar beets.
5. INSECTS CONTROLLED: Aphid, Colorado potato beetle, flea beetle, leafhopper, sugar root maggot.
6. WHEN USED: Aphids - post-emergence, from 75% emergence up to 6 weeks after emergence. Other pests - at planting time. Only 1 application per year for field crops.
7. HOW TO APPLY:
   With: Ground equipment. Do not use applicators that would grind granules.
   Rate:

Crop	Insect	kg/ac	g/100 m row
Potato	Colorado potato beetle, flea beetles, leafhoppers.	9.0	200
	Aphids	4.5	100
Sugar beets	Sugar beet root maggot	4.5	100

   Incorporation: ***Furrow Treatment:*** Apply granules with seed in the planting furrow and cover with soil. ***Band Treatment:*** At planting, apply granules in a 20 cm wide band and work into the soil or cover with soil to a depth of 10 cm. Plant seed pieces in the treated zone. ***Side Dressing:*** At post-emergence, drill granules at a depth of 8-20 cm (usually 2.5-5 cm below the seed pieces) on both sides of the row, 5-10 cm from the row.
8. APPLICATION TIPS: • Calibrate and adjust application equipment to insure proper rate and accurate placement. • Do not mix granules directly with water. • Deep disc spills at row ends immediately to prevent birds from feeding on exposed granules. • Do not apply to crops in bloom. • Do not apply to very dry soil unless treatment is followed by irrigation.
9. HOW IT WORKS: Aldicarb is a soil-applied, systemic, carbamate insecticide. Soil moisture is required to release the active chemical from the granules (corn cob grits) so irrigation or rainfall should follow application. Uptake by roots is rapid; residual activity varies with dosage and pests involved but often lasts more than 6 weeks.
10. EXPECTED RESULTS: Active ingredient is rapidly absorbed by root systems and translocated upwards throughout all parts of the plant. Residual activity varies with dosage and pests involved, but often lasts more than 6 weeks.
11. EFFECTS OF RAINFALL: Not effected by rainfall.
12. MOVEMENT IN SOIL: The following environmental conditions, when present and in combination reduce the rate of degradation of Temik in soil and may allow movement of product residues to ground waters: • Cool soil temperatures at time of application (below 10°C in root zone). • Heavy anticipated seasonal rainfall within 1 month after use. • Sandy or loamy sand soils and subsoils (field moisture holding capacity less than 15% by volume) with low organic matter (less than 1% in top 30 cm of soil). • Acidic subsoils (pH less than 6.0). • Fields that overlie shallow water tables less than 15 m deep. When all of the above conditions are met, do NOT apply. Contact Union Carbide (1-403-253-8471) if there is any question of whether your location meets these conditions.
13. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): potatoes, sugar beets (90). Do not harvest sugar beet tops for livestock feed within 120 days of application. Do not use tops from treated beets as food for humans. Do not use plant parts for food or feed. Do not plant food crops in soil treated with this product for at least 1 year after treatment.
14. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (0.6). Toxic to fish, birds, and other wildlife. Birds feeding on treated areas may be killed.
15. PRECAUTIONS, FIRST AID: Avoid any contact with the product. Wear protective, long-sleeved clothing, goggles, pesticide respirator, and rubber gloves. After work, wash entire body with soap and water. Wash contaminated clothing and protective equipment in a strong solution of washing soda and rinse thoroughly. ***Symptoms of poisoning:*** weakness, headache, sweating, nausea, vomiting, diarrhea, tightness in chest, blurred vision, pinpoint pupils, abnormal flow of saliva, abdominal cramps, unconsciousness. ***First Aid:*** CONTACT A PHYSICIAN IMMEDIATELY IN ALL CASES. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Give water, repeat until vomit fluid is clear. Start artificial respiration if victim stops breathing. Get medical attention immediately. IN EMERGENCY, telephone collect 24 hours a day 1-(514)645-5311. ***For Physician:*** **Atropine sulphate is antidote.** As much as 2-4 mg may be needed every 10-12 minutes until patient is fully atropinized. Dosage for children is appropriately reduced. Do not use opiates or cholinesterase-inhibiting drugs.

16. STORAGE: Do not refrigerate.

17. DECONTAMINATION AND DISPOSAL: ***Spills on Floors:*** Use a sweeping compound to clean up. Decontaminate the waste with a solution of caustic soda, a strong commercial bleach and detergent. Wash floor with decontamination solution and rinse well with clean water. Clean up solution and rinse water with absorbent material such as sawdust, sweeping compound or rags.
Spills on Ground: Collect the material and dispose of it as described for floors. Treat the affected area with the decontamination solution and cover with clean soil. ***Decontamination Solution:*** Into 10 L of water, slowly and carefully add in sequence 130 g detergent, followed by 525 g caustic soda (lye) and finally 1.2 L of commercial bleach (sodium hypochlorite). Handle and use solution with great care. Do NOT add water to dry lye.

THIMET (phorate)

Cyanamid

1. FORMULATIONS: Granular; Thimet 15-G; 15%; 23 kg bag.
2. MARKETING CATEGORY: Restricted
3. REGISTERED MIXES:
4. CROPS: Beans, potatoes.
5. INSECTS CONTROLLED:

aphids	leafhopper	lygus bug	thrips
Colorado potato beetle	leafminer	mites	

6. INSECTS SUPPRESSED: Potato flea beetle, wireworm.
7. WHEN USED: One application at planting time.
8. HOW TO APPLY:
   With: Granular pesticide applicator.
   Rate:

Crop	Insect	Quantity
Beans	Aphids, leafhopper, lygus bugs, mites, thrips.	2.95-4.45 kg/ac
Potatoes	Aphids, leafhoppers, leafminers, reduction of potato flea beetle and wireworm damage, Colorado potato beetle (early season control).	140 g/100 m row (sandy soils) 215 g/100 m row (loams to clay soils)

   Incorporation: Beans - distribute in the row to the side of seed. Potatoes - distribute evenly in the furrow on each side of the row.
9. APPLICATION TIPS: • Do not place in direct contact with the seed. • Do not use in muck soils. • Do not apply to any area not specified on the label.
10. HOW IT WORKS: A systemic, organophosphorus insecticide with effective initial residual activity against soil insects and other arthropods.
11. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (29). Acute dermal LD_{50} rabbits (mg/kg) = (226). Highly toxic to fish, birds, and other animals. Poisonous by skin contact, inhalation or swallowing. Repeated inhalation or skin contact may, without symptoms, progressively increase susceptibility to poisoning.
12. PRECAUTIONS, FIRST AID: ***Protective Equipment:*** Protective clothing, dust mask and rubber gloves (with cuffs over glove ends) while handling product. Do NOT handle with bare hands. Wear freshly laundered, long-sleeved work clothing daily. Clothing and gloves should be washed with soap and water after each use. Do NOT use the same gloves for other work. Destroy and replace gloves frequently. Pour downwind and allow as little free fall as possible. DO NOT BREATH DUST. Keep all unprotected persons out of the operating areas. Do NOT get in eyes, on skin, or clothing. Wash thoroughly before eating, drinking and smoking. Bathe and change outer clothing after each work day. KEEP OUT OF REACH OF CHILDREN AND ANIMALS. ***Symptoms of poisoning:*** weakness, headache, tightness of chest, blurred vision, nonreactive pinpoint pupils, salivation, sweating, nausea, vomiting, diarrhea and abdominal cramps. ***First Aid:*** CALL A PHYSICIAN AT ONCE IN CASE OF SUSPECTED POISONING. IN EMERGENCY endangering life or property call collect day or night 613-996-6666. Antidote is atropine. IF INHALED - remove to fresh air. If not breathing give artificial respiration, preferably mouth to mouth. If breathing is difficult, give oxygen. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Remove contaminated clothing and shoes. IF SWALLOWED - induce vomiting (see page 6). ***For Physician:*** Give atropine intramuscularly or intravenously depending on severity of poisoning, 2-4 mg every 10 minutes until fully atropinized. 20-30 mg, or more may be required during the first 24 hours. Never give opiates or phenothiazine tranquillizers or other depressants. Clear chest by postural drainage. Artificial respiration or oxygen administration may be necessary. Observe patient continously for at least 48 hours. Repeated exposure to cholinesterase inhibitors may, without warning, cause increasing susceptibility to very small doses of any cholinesterase inhibitor. Allow no further exposure to any cholinesterase inhibitor until cholinesterase regeneration has taken place. Pralidoxime chloride (2-PAM: Protopam chloride) may be effective as an adjunct to atropine. Use according to label directions.

13. STORAGE: Do not use or store in or around the home. Must be stored or displayed AWAY from food and feed. Store open bags in labelled sealed drums or heavy plastic bags.

14. DECONTAMINATION AND DISPOSAL: ***Procedure for decontamination of surfaces:*** Keep unprotected persons out of the contaminated area. **Protective Equipment:** Hat, overalls, rubber apron, rubber boots and rubber gloves. DO NOT ALLOW product to contact eyes and skin. Launder clothing and clean protective equipment after use. **WARNING:** AVOID smoking, open flames and sparks in the operating area as the decontamination procedure involves use of alcohols.
• Cover spilled granules with an absorbent material such as sweeping compound to minimize dust. Sweep up granules and place in a tightly closed labelled container. Store in a secure place. Contact Cyanamid Canada Inc. or federal authorities for details on how to detoxify product. Granules that remain in a broken bag should be transferred to a clearly marked, tightly closed alternate container. Dispose of material in accordance with provincial requirements. • Wash surface with a bleach decontamination solution prepared by mixing 9 L water with 1 L commercial bleach and 0.5 L rubbing alcohol. Rinse with clean water. Clean up the liquid with absorbent material such as sawdust, sweeping compound or other materials. Repeat washing with bleach solution and water until liquid is cleaned up. • Dispose of contaminated absorbent material in accordance with provincial requirements. • Wash disposal equipment with bleach solution and rinse with clean water. • If spill occurs on the ground, collect material and dispose as directed. Treat affected area with the decontamination solution and cover with clean soil.

THIODAN (endosulfan)

Hoechst

1. FORMULATIONS: Emulsifiable Concentrate; 400 g/L; 10 L container. Wettable Powder; 50%; 2 kg bag.

2. REGISTERED MIXES: Endosulfan is compatible with most insecticides and fungicides except Bordeaux mixture, hydrated lime, calcium arsenate or zinc sulphate. ***Mixing Instructions:*** Wettable powder - fill spray tank nearly full and either pour recommended amount on water surface or pre-mix powder in a bucket 1/2 filled with water then pour mix through screen into nearly filled spray tank. Finish filling tank. Keep agitator running during filling and spraying.

3. CROPS:

alfalfa	clover	peas (canning)	sugar beets
beans (except lima)	corn (field, sweet)	potatoes	sunflowers

4. INSECTS CONTROLLED:

beet webworm	corn leaf aphid	potato aphid	sunflower beetle
black bean aphid	green peach aphid	potato flea beetle	tarnished plant bug
Colorado potato beetle	pea aphid	potato leafhopper	tuber flea beetle
corn earworm	pea weevil	spittle bug	

5. WHEN USED: Apply when insects first appear. Repeat as necessary unless directed otherwise. ***Alfalfa, clover*** - Apply soon after spittle bug eggs hatch. Do not apply when bees are present. ***Corn, peas*** - Do not apply more than twice per season. Apply to peas only if crop is havested by combine. ***Sugar beets, sunflowers*** - Do not apply more than once per season.

6. HOW TO APPLY:
With: Aircraft or Ground equipment.
Rate: Lower rate for young insects (larvae), light infestations or sparse foliage.

Crop	Insect	EC/WP	Qty/ac	Crop	Insect	EC/WP	Qty/ac
Alfalfa, clover.	Spittle bug	EC	0.3 L/ac	Potatoes	Colorado potato beetle,	EC	0.6 L/ac
Beans (except lima)	Black bean aphid, potato leafhopper.	EC	0.6 L/ac		flea beetle, leafhopper, potato aphid, tuber flea beetle.	WP	0.4 kg/ac
Corn (field, sweet)	Corn earworm	EC	1.1-1.7 L/ac		Tarnished plant bug	EC	0.8 L/ac
	Corn leaf aphid	EC	1.1 L/ac			WP	0.6 kg/ac
Peas (canning)	aphid, weevil	EC	0.6-0.8 L/ac	Sugar beets	Beet webworm	EC	1.1 L/ac
					Green peach aphid	EC	0.8 L/ac
				Sunflower	Sunflower beetle	EC	0.6 L/ac

Water Volume: Thorough wetting of all plant parts is essential for good results.

7. APPLICATION TIPS: • Apply during late evening. Spray upper and lower leaf surfaces. • Prevent sprays or dusts from drifting to areas occupied by people or animals.

8. HOW IT WORKS: A non-systemic, organochloride insecticide/acaricide with both contact and stomach action.

9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest intervals (days): alfalfa, clover (30); beans (2); corn (50); peas (7); potatoes (0); sugar beets (45); sunflower (60). Do not feed treated crop refuse (vines, tops, stocks, threshings, sugar beet or sunflower foliage) to livestock. Sugar beet roots may be fed. Do not ensile treated corn. Do not feed fresh, dry or ensile vines and pods of treated peas to livestock. Do not graze treated green crops except for alfalfa and clover which should not be foraged within 30 days of application. ***Succeeding crops:*** Do not apply to crops which are to be followed by a root crop other than carrots, potatoes, sweet potatoes, or sugar beets.

10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = technical (80-110). Toxic to bees. Highly toxic to fish. Moderately toxic to birds and mammals.

11. PRECAUTIONS, FIRST AID: Wear goggles, respirator, coveralls, and synthetic rubber gloves. Change clothing daily and wash before reuse. ***Symptoms of poisoning:*** nausea, headache, general feeling of being unwell, followed by generalized convulsion. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes immediately. IF WETTABLE POWDER IS SWALLOWED - induce vomiting (see page 6). Repeat until vomit is clear. Get immediate medical attention. IF EMULSIFIABLE CONCENTRATE IS SWALLOWED - do NOT induce vomiting. Avoid breathing vomitus into the lungs should vomiting occur. Get immediate medical attention.

12. STORAGE: Do not store E.C. below -7°C.

13. DECONTAMINATION AND DISPOSAL: ***Spilled powder*** Cover with sawdust or dirt to prevent scattering. Apply sodium carbonate, caustic soda or hydrated lime on contaminated area. After 1 hour collect and wash paved areas with water. ***Spilled liquid*** Decontaminate with any of above alkaline chemicals and allow to stand for 1 hour. Apply sawdust, talc, or sand to absorb all liquid. Decontaminate tools with hydrated lime. Dispose of waste in accordance with provincial requirements.

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CHEMICAL CONTROL OF PLANT DISEASES IN ALBERTA

Introduction

Plants, like other living organisms, are attacked by many diseases that are caused by fungi, bacteria, viruses, mycoplasmas and nematodes. The management of plant diseases is based on 4 general parameters that include:

a) **Exclusion** or quarantine, i.e. prevention of a disease organism or diseased plant material from entering a country or disease-free area where the disease could become established;

b) **Protection** whereby proper sanitation practices, chemical controls, adequate soil nutrient levels and good soil drainage may be used to protect plants from disease organisms;

c) **Eradication** involving the use of crop rotations or the application of eradicant chemicals such as fungicides; and

d) **Plant breeding** whereby crop plants are selected for partial or complete resistance to a specific disease or range of infectious diseases.

Chemical Control of Disease

In Alberta, fungal diseases of some field crops may be subject to direct chemical control by fungicides. Control of most other field crop diseases rely on alternate methods. The major use of fungicides in these crops at present is in the treatment of seeds (cereal, forage, oilseed) and potato seed pieces. This situation may change in the near future as grain growers move to adopt more intensive crop management methods in an attempt to increase meagre profit margins. In 1986 DITHANE M-45 and BAYLETON were given temporary registrations for control of wheat foliar diseases.

At present foliar fungicides are only registered for sclerotinia white mold control in canola and field beans as well as several fungicides for control of foliar diseases of potatoes. For convenience, dual purpose treatments with the insecticide lindane, used in seed-treatment formulations, have been included in this chapter on fungicides. The principles and procedures involving the use of plant disease control chemicals follow the guidelines outlined for chemical weed control in the first chapter of this manual.

AGROX N-M, N-M DRILL BOX, DITHANE M-22 (maneb)

Chipman/Federated Co-op/Rohm and Haas

1. FORMULATIONS: ***Seed Treatments:*** Flowable - 300 g/L; Agrox Flowable; 10 L, 200 L drum. Powder - 50%; Agrox N-M; 12 X 1 kg, 4 kg bags. Co-op N-M Drill Box; 1 kg bag. Pool N-M Drill Box; 1 kg bag. ***Foliar Spray:*** Wettable Powder - 80%; Dithane M-22; 10 kg bag.

2. REGISTERED MIXES: With lindane as dual purpose formulations. Compatible with most insecticides and fungicides but not with Bordeaux mixture or lime.

3. CROPS: Barley (except Palliser), flax, oats, potatoes, rye, sugar beets, wheat.

4. FUNGI CONTROLLED:

bunt (rye, wheat)	early and late blight (potatoes)	net blotch (barley)	stinking smut (wheat)
covered smut (barley, oats)	false loose smut (barley)	root rot (cereals)	
damping-off (flax, sugar beets)	loose smut (oats)	seedling blight (cereals)	

5. WHEN USED: Pre-seeding or Drill Box Treatment - treat seed before sowing. Seed should be well cured, dry, and cleaned before treatment. Do not store treated grain more than 1 year. Potatoes - apply early (when plants are 15 cm high) and treat at 7-10 day intervals throughout the season. Shorten interval to 5-7 days when weather favours disease.

6. HOW TO APPLY: ***Pre-seeding Treatment*** apply with any standard dry seed treatment application equipment or the shovel method. ***Drill Box Treatment*** At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix product and seed thoroughly until seed is a uniform colour by the following alternate mixing methods (Do NOT mix with hands): (a) Place and level 1/2 of the seed in drill box and sprinkle 1/2 of the required amount of product uniformly over seed. Mix thoroughly with a paddle. Fill box with seed and sprinkle remaining 1/2 of product over seed, mix again. **OR** (b) Dribble the required amount of product into seed as it is poured into drill box. Thoroughly mix with a paddle when drill box is 1/2 full and again when full. **OR** (c) Apply through a mechanical dispenser or proportioner that attaches to the auger that conveys seed into the drill box.

Rate: Potatoes - increase the rates as vines increase in size.

Crop	Disease	Powder g/25 kg seed	Flowable mL/25 kg seed
Barley (except Palliser)	Net blotch, seedling blight, smuts (covered, false loose), root rot.	50-66	85
Flax	Seedling blight, damping-off, root rot.	110-112	- (not registered)
Oats	Seeding blight, smuts, root rot.	69-92	115
Rye	Bunt, seedling blight, root rot.	25-43	45
Sugar beets	Damping-off	100	- (not registered)
Wheat	Bunt or stinking smut, seedling blight, root rot.	25-40	45

Crop	Disease	g/ac
Potatoes	Early blight, late blight.	700-910

Water Volume: Potatoes - 325-405 L/ac; Heavy vines - 405-610 L/ac. Agrox N-M Slurry Treatment - adjust the machine to apply 140-190 mL of slurry/25 kg seed, ensuring that the rates of treatment are applied/25 kg seed.

7. APPLICATION TIPS: • Treat only the amount of seed to be sown to avoid the problem of storing treated seed. • Slurry treatment not recommended for flax. • Agitate Agrox Flowable thoroughly before using. • Calibrate treater prior to treating seed. Use only recommended rates. Lower amounts may not give the desired control. Excessive amounts may cause seed injury.

8. HOW IT WORKS: Maneb is a fungicide, effective against many seedling and foliar diseases.

9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): potatoes (1). Do not feed treated seed to livestock. Do not expose treated seed to birds and other wildlife.

10. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = maneb (6,750).

11. PRECAUTIONS, FIRST AID: ***Protective Equipment:*** Wear a dust mask, goggles, long-sleeved shirt, rubber or PVC gloves and rubber or PVC apron when handling product. Wash thoroughly after handling or before eating or smoking. Ventilate indoor working area. Do not apply or allow to drift to areas occupied by unprotected persons or to streams, lakes or ponds to protect wildlife. Avoid contamination of feed or food, including such crops on which residue is unsafe. Keep away from fire and sparks. Stored treated grain should be labelled ***"Do not use for food or feed. This seed has been treated with maneb. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - induce vomiting (see page 6). Repeat until vomit is clear. Take patient to nearest hospital taking the labelled container with you.

12. STORAGE: Store product in a cool, dry place away from food or feed. Keep away from fire and sparks. Prevent the contents from becoming wet as this will reduce effectiveness and may cause flammable vapours.

BAYLETON (triadimefon)

Chemagro

1. FORMULATIONS: Wettable Powder; 50%; 4 X 250 g PVA water soluble packets.
2. MARKETING CATEGORY: Restricted - Studies on the safety of this product for users and spray operators are not complete. Directions for use and precautionary statements should be followed carefully. Read the label.
3. REGISTERED MIXES: ***Mixing Instructions:*** Add 1/4-1/3 required amount of water to tank, start agitation. After opening outer bag, drop the required number of unopended inner packets into tank as directed. Maintain adequate agitation prior to and during spraying. ***Mix Restrictions:*** Do not use PVA packets directly in diesel oils or summer spray type oils as in ULV or LV uses. Do not mix PVA packets with products that contain boron or release free chlorine because the resultant reaction is a plastic; which is not soluble in water or solvents such as diesel oils, kerosene, gasoline, or alcohol.
4. CROPS: Wheat (winter).
5. FUNGI CONTROLLED: Powdery mildew, rusts (leaf, stem, and stripe).
6. WHEN USED: Apply when disease symptoms first appear. Additional applications should be made if new disease symptoms appear, up to a total of 445 g/ac per crop season.
7. HOW TO APPLY:
   With: Ground equipment.
   Rate: 100-225 g/ac. Areas where severe powdery mildew or rust infections are expected - 160-225 g/ac may be required. Total amount must not exceed 445 g/ac per crop season.
   Water Volume: 40-120 L/ac. Use higher volume where the crop foliage is dense.
8. APPLICATION TIPS: • Complete coverage and thorough application are essential for effective disease control, especially when lower volumes of spray are used. • Use the higher rate for the most disease susceptible varieties.
9. HOW IT WORKS: A sterol-inhibiting fungicide with both contact and systemic action. It inhibits certain fungi from producing ergosterol. A protective, curative, and eradicant fungicide.
10. GRAZING AND HARVEST RESTRICTIONS: Do not apply within 60 days of harvest. Do not feed forage to cattle.
11. TOXICITY: Moderate acute mammalian toxicity. May be fatal if swallowed. Harmful if inhaled or absorbed through skin. Causes reversible eye damage.
12. PRECAUTIONS, FIRST AID: Do not handle packets excessively or expose to moisture since this may cause breakage. Do not handle with wet hands. Wear protective clothing, including rubber or neoprene gloves. Wash thoroughly after use and before eating or smoking. Wash contaminated clothing before reuse. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** does not cause any definite symptoms that would be diagnostic. Poisoning is accompanied by hyperactivity followed by sedation.
13. STORAGE: In a cool dry place but not below freezing (0°C).

BENLATE (benomyl)
DuPont

1. FORMULATIONS: Wettable Powder; 50%; 2 kg, 22.7 kg bags.
2. REGISTERED MIXES: With fungicides captan, mancozeb, thiram. Dual purpose formulations with insecticide, lindane. ***Mix Restrictions:*** Do not mix with alkaline pesticides such as basic copper sulphate, Bordeaux mixture or lime sulphur. Do not tank mix or alternate Benlate with thiophanate products such as Easout. ***Mix Instructions:*** Add 1/2 the required water, add Benlate. Continuous agitation is required to keep material in suspension. Spray mixture should be used on the day prepared.
3. CROPS: Beans (dry, lima, snap), canola.
4. FUNGI CONTROLLED: *Botrytis* (beans), *Sclerotinia* (beans, canola).
5. WHEN USED: Apply only once per season. ***Beans:*** between 50% and full bloom. ***Canola:*** during 20-30% bloom. This will usually be 4-7 days after the first blossoms appear.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate: use the high rate under severe disease conditions.

Crop	Disease	g/ac
Beans, (dry, lima, snap)	*Botrytis* (gray mould), *Sclerotinia* (white mould).	710-910
Canola	*Sclerotinia* (stem rot)	405-605

   Water Volume: Beans - Air 16 L/ac. Ground 40-80 L/ac. Canola - Air 16 L/ac minimum. Ground 32-40 L/ac.
   Nozzles: Hollow cone or disc core provide uniform coverage.
7. APPLICATION TIPS: • Canola - apply with high clearance boom. • Repeated exclusive use of Benlate may lead to buildup of resistant strains of fungi and loss of disease control.
8. HOW IT WORKS: Benomyl is a protective systemic fungicide.
9. EFFECTS OF RAINFALL: Do not apply when rain is imminent. Do not irrigate within 6 hours of application.
10. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): beans (14). Do not graze or feed treated bean hay to livestock.
11. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) is greater than (10,000). May irritate eyes, nose, throat and skin. Toxic to fish.
12. PRECAUTIONS, FIRST AID: Do not apply when weather conditions favor drift from treated areas. KEEP OUT OF REACH OF CHILDREN. Avoid breathing dust or spray mist. Avoid contact with skin, eyes, and clothing. Keep away from fire or sparks. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for the eyes.
13. STORAGE: Never allow product to become wet during storage as reduced fungicidal effectiveness may result. Keep container closed when not in use. Keep away from fire or sparks.

BENOLIN-R, THIRALIN-PLUS (benomyl + thiram + lindane)
Fungicide-Insecticide
Federated Co-op/May & Baker

1. FORMULATIONS: Dusts - Benolin-R; 6 + 10 + 50%; 1.5 kg, 6 kg bags. Thiralin-Plus; 6 + 10 + 75%; 1 kg bag.
2. CROPS: Canola
3. FUNGI CONTROLLED: Blackleg (Phoma), seedling blight, seedling decay.
4. INSECTS CONTROLLED: Canola flea beetles
5. WHEN USED: Pre-seeding or drill box treatment. ***Benolin-R*** - dry treated seed may be stored for several months. Oil dressed seed should be sown within 1 week. ***Thiralin-Plus*** - treated seed may be stored up to 3 months.
6. HOW TO APPLY: Seed to be treated with Benolin-R may be first treated with canola or vegetable oil (135 mL/100 kg seed) to improve contact between seed and product. Thiralin-Plus has an added adhesive. ***Pre-seeding Treatment (preferred method):*** use a commercial drum or auger, dust seed-treater or a cement mixer. ***Drill Box Treatment:*** At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix powder and seed thoroughly until seed is uniform colour by either of the following alternate mixing methods (Do NOT mix with hands): (a) fill 1/2 the drill or planter box and sprinkle 1/2 the required amount of powder over the seed. Mix with a paddle. Add enough seed to fill the box, cover with the remaining 1/2 of powder and mix again. For large boxes, it may be necessary to divide the seed into several portions. OR (b) dribble the required amount of powder into each 25 kg of seed as it is poured into the drill box. Thoroughly mix with a lath or paddle when the drill box is 1/2 full and again when full.

Rate:

Crop	Disease	Insect	Formulation	g/25 kg seed
Canola	Blackleg, seed decay, seedling blight.	Flea beetles	Benolin-R	800
			Thiralin-Plus	750

7. APPLICATION TIPS: • Check the seed drill calibration before and during seeding operation. • Clean planter plates periodically to prevent excessive build-up of chemicals. Under certain circumstances, for example, if excessive oil is added, the seed may bridge in the seed drill.
8. HOW IT WORKS: Benomyl is a systemic fungicide that protects against blackleg. Thiram fungicide protects against seed-borne diseases. Lindane, an organochlorine insecticide that acts by ingestion, contact and, to a lesser extent, by fumigant action against many soil-dwelling insects.
9. EXPECTED RESULTS; ***Insects:*** provides protection against flea beetles during germination and early emergence only.
10. GRAZING AND CROPPING RESTRICTIONS: Do not leave treated seed exposed to birds or other animals. Do not use on soil in which edible root crops (except rutabagas and turnips) are to be planted in the same or following season.
11. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = benomyl (710,000), thiram (780-865), lindane (88-270), Thiralin-Plus (40-200). Lindane is toxic to fish, birds, and other animals. Poisonous if swallowed, inhaled or absorbed through the skin.
12. PRECAUTIONS, FIRST AID: Wear dust mask, goggles, rubber gloves, and protective clothing. Wash thoroughly after handling or using and before eating or smoking. Consumption of alcohol 24 hours before or after working with thiram may cause sweating, flushing and nausea. Stored seed should be labelled ***"Do not use for food, feed, or oil processing. This seed has been treated with benomyl+thiram+lindane. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Lindane - nausea, vomiting, hyperirritability, convulsions, coma. Skin contact with fungicides may result in irritation and dermatitis. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 8). IF SWALLOWED - induce vomiting (see page 6). Give epsom salts as a laxative, avoid mineral oils and castor oil. Get medial attention. ***For Physician:*** Lindane is an organochlorine insecticide. Barbiturates may be given to control convulsions. Oxygen may be indicated. Avoid use of morphin and adrenaline.
13. STORAGE: Do not store in the home or near food or feed. NEVER allow product to become wet during storage (this may lead to chemical changes which will reduce effectiveness of the benomyl fungicide). Keep container closed when not in use.

DITHANE M-45, MANZATE 200, TUBERSEAL (mancozeb)

Rohm and Haas/DuPont/Chipman

1. FORMULATIONS: Wettable Powder - Dithane M-45; 80%; 20 kg bag. Manzate 200; 80%; 10 kg, 20 kg, 25 kg bags. Dust - Tuberseal; 16%; 10 kg, 20 kg bags.

2. REGISTERED MIXES: A dust may be prepared by diluting and thoroughly mixing Manzate 200 with prophylite or other neutral diluent; commonly used insecticides may displace an equivalent amount of diluent. Use dust mixtures as soon as possible after preparation. A spreader-sticker may be added to Manzate 200 in spray preparations.

3. CROPS: Corn, potatoes, sugar beets, wheat (durum, semi-dwarf, soft white, spring, winter).

4. FUNGI CONTROLLED:

cercospora leaf spot (sugar beet)	leaf rust (wheat)	septoria (wheat)
early and late blights (potato)	root rot (corn)	tan spot (wheat)
fusarium decay (potato)	seedling blight (corn)	

5. WHEN USED: Potato seed pieces and corn seed - treat before planting. Early and late blights in potatoes - apply when plants are 10-15 cm tall; repeat at 7-10 day intervals. Cercospora leaf spot in sugar beets - apply when disease first threatens and repeat at 7-10 day intervals. Foliar spray on wheat - apply when flag leaf has fully emerged and again 7-10 days later when the head has fully emerged.

6. HOW TO APPLY:

With: Potato seed duster, aircraft, ground equipment.

Rate: Potatoes - Start with low rate and increase to maximum rate as foliage develops.

Crop	Disease	Formulation	Quantity
Corn seed	Root rot, seedling blight.	Manzate 200	0.22 kg/100 kg seed
Potato seed pieces	Fusarium decay	Tuberseal	0.5 kg/100 kg seed
		Manzate 200	1.0 kg/100 kg seed
Potatoes (foliar spray)	Early and late blight	Dithane M-45, Manzate 200	0.44-0.90 kg/ac
Sugar beets (foliar spray)	Cercospora leaf spot	Dithane M-45, Manzate 200	0.91 kg/ac
Wheat (foliar spray)	Leaf rust, tan spot, septoria.	Dithane M-45	0.9 kg/ac

Water Volume: Aircraft - 16 L/ac; Ground - 40-81 L/ac; Sugar beets - 324 L/ac.

Pressure: 345 kPa.

Nozzles: hollow cones or flat fan recommended.

7. APPLICATION TIPS: ***Corn Seed:*** apply as dust or slurry. Treated seed should not be stored. ***Potato Seed Pieces:*** Thoroughly coat the surface of whole or cut potato pieces. If treated whole seed is cut, make a second application. Plant as soon as possible after treating. If planting is delayed beyond 2 days after treating, seed should be air dried before bagging or loose piling. ***Sprays:*** continuous agitation required.

8. HOW IT WORKS: A protective, seed-treatment fungicide that controls fusarium decay. A contact fungicide.

9. GRAZING AND HARVEST RESTRICTIONS: Pre-harvest interval (days): potatoes (1), sugar beets (21), wheat (40).

10. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = mancozeb (12,000). Prolonged exposure may cause eye, nose, throat and skin irritation.

11. PRECAUTIONS, FIRST AID: When treating or handling treated seed, work in a well ventilated area, and wear a suitable dust mask, goggles and gloves. Treated seed should be labelled ***"Do not use for food or feed. This seed has been treated with mancozeb. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling and before eating, drinking and smoking. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.

12. STORAGE: Store in a cool, dry, ventilated place; away from fire and sparks. Do not allow product to become wet or overheated during storage as chemical changes may reduce fungicidal effectiveness and flammable vapors may be generated.

FORMALIN (formaldehyde)

Later Chemicals

1. FORMULATIONS: Solution; 37%; 4 L container.

2. CROPS: Barley, oats, potatoes, wheat.

3. FUNGI CONTROLLED:

black scurf/rhizoctonia (potatoes)	common scab (potatoes)	loose smut (oats, except hulless)
bunt (wheat)	covered smut (barley, oats, wheat)	

4. WHEN USED: Treat seed before planting. Sow treated seed as soon as possible.

5. HOW TO APPLY:

With: Small sprayers or sprinklers.

Grain Seed Treatment: Pile grain on floor and mix with solution until until grain is wet. Cover for 4 hours or overnight. If smut balls are present, immerse grain in solution for 5 minutes. Stir and skim off smut balls. ***Potato Seed Treatment:*** Cold Treatment - soak uncut tubers for 2 hours. Hot Treatment - Heat solution to 49-52°C and immerse uncut tubers 3-4 minutes. Cover for 1 hour. Let dry before cutting and planting.

Rate:

Crop	Disease	mL solution/25 kg grain
Barley	Covered smut	37
Oats	Smuts (covered, loose)	37
Wheat	Bunt, covered smut	37
		mL formalin/10 L water
Potato tubers	Common scab, black scurf (rhizoctonia)	50 cold **OR** 100 hot

Water Volume: Barley, wheat - 300 mL formalin/100 L water. Oats - 50% formalin : 50% water

6. HOW IT WORKS: Formaldehyde is a bactericide and fungicide, used as a soil fumigant and seed treatment, although the latter use is limited by phytotoxicity. (1 mL solution = 1.08 g)

7. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = formalin (800). May cause irritation of skin, eyes, nose, and throat.

8. PRECAUTIONS, FIRST AID: Wear a gas mask and gloves. Work in a well ventilated area. Avoid prolonged or repeated contact or breathing of vapor. Keep away from heat, fire and sparks. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Skin contact may produce irritation and dermatitis. Ingestion may cause severe abdominal pain, nausea, and vomiting, sometimes followed by stupor. Exposure to vapours may cause burning and stinging of eyes and headache. ***First Aid:*** IF INHALED - remove patient to fresh air; have him lie down and keep quiet and warm. Give patient egg white and milk; obtain medical attention. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Repeat until vomit fluid is clear. Rush patient to nearest hospital taking the labelled container with you.

9. STORAGE: Keep containers tightly closed, away from fire and sparks. Do not freeze. Minimum storage temperature 15°C. Store in a dry, ventilated place, away from food and feed.

GAMMASAN^{+} (benomyl + captan + lindane)

Fungicide-Insecticide

Chipman

1. FORMULATIONS: Dust - Gammasan $^{+}$; 6 + 10 + 50%; 4 kg bag. Suspension - Gammasan $^{+}$ F; 2.7 + 4.5 + 22.6%; 2 X 10 L pack.
2. CROPS: canola, mustard.
3. FUNGI CONTROLLED: Blackleg (*Leptosphaeria maculans*) in canola. Pre-emergent seedling blight and seed decay in canola, mustard.
4. INSECTS CONTROLLED: Flea beetles
5. WHEN USED: Pre-seeding or Drill Box Treatment - treat seed before sowing. Gammasan^{+} dry treated seed may be stored for several months. Oil dressed seed should be sown within 1 week of treating. Gammasan $^{+}$ Flowable treated seed should not be stored for more than 3 months before planting.
6. HOW TO APPLY: ***Gammasan*** $^{+}$ ***Flowable:*** use liquid seed treating equipment. ***Gammasan*** $^{+}$ ***:*** Pre-seeding Treatment (preferred method) - Treat seed in an end-over-end drum-type seed treater or a cement mixer. Drill Box Treatment (follow directions carefully - mis-application may result in drill plugging) - At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix powder and thoroughly until seed is a uniform colour by either of the following alternate mixing methods (Do NOT mix with hands): (a) Place and level 1/2 of the seed in drill or planter box and sprinkle 1/2 the required powder uniformly over surface. Mix thoroughly with a paddle, then fill the box with seed and sprinkle the remaining 1/2 powder over the seed and mix. **OR** (b) Dribble 775 g of powder into each 25 kg of seed as it is poured into the drill box. Thoroughly mix with a lath or paddle when the drill box is 1/2 full and again when full.
   Rate: Higher rate in areas of heavy flea beetle infestation (generally only produced by successive cropping of flea beetle-susceptible crops on the same or immediately adjacent areas).

Crop	Disease	Insect	Qty/25 kg seed
Canola	Blackleg (*Leptosphaeria maculans*)	Flea beetles	750-1550 g OR 1250 mL
Canola, mustard.	Pre-emergent seedling blight, seed decay.	Flea beetles	750-1550 g OR 1250 mL

7. APPLICATION TIPS: • With high rate, use 150 mL mineral oil or linseed oil as a sticker per 25 kg seed. Churn or mix the seed and oil then add powder and mix again. • Use high rate only with planting equipment that can be adjusted to compensate for increased seed coating.
8. HOW IT WORKS: Benomyl systemic fungicide protects against blackleg. Captan fungicide protects young plants against rots and seedling blight. Lindane organochlorine insecticide which acts by ingestion, contact and, to a lesser extent, by fumigant action against many soil-dwelling insects.
9. EXPECTED RESULTS: ***Insects:*** provides protection against flea beetles during germination and early emergence only.
10. GRAZING AND HARVEST RESTRICTIONS: Do not leave treated seed exposed to birds or other animals.
11. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = benomyl (710,000), captan (9,000), lindane (88-270). Lindane is toxic to fish, birds, and other animals. Poisonous if swallowed, inhaled or absorbed through the skin.
12. PRECAUTIONS, FIRST AID: Wear a respirator, goggles, rubber gloves, and long sleeved clothing. Work in a well ventilated area. Wash thoroughly after handling and before eating or smoking. Stored seed should be labelled ***"Do not use for food, feed, or oil processing. This seed treated with benomyl+captan+lindane. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Lindane - nausea, vomiting, hyperirritability, convulsions, coma. Skin contact with fungicides may result in irritation and dermatitis. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Give epsom salts as a laxative, avoid mineral oils and castor oil. Get medical attention. ***For Physician:*** Lindane is an organochlorine insecticide. Barbiturates may be given to control convulsions. Oxygen may be indicated. Avoid use of morphine and adrenalin.
13. STORAGE: Do not store in the home or near food or feed. NEVER allow product to become wet during storage (this may lead to chemical changes which will reduce the effectiveness of the benomyl fungicide). Keep container closed when not in use.

MERGAMMA, N-M DUAL (maneb + lindane)
Fungicide-Insecticide
Chipman/Federated Co-op

1. FORMULATIONS: Dusts - 37.5 + 18.75%; Co-op NM Dual; 1kg bag. Mergamma N-M; 12 X 1 kg, 4 X 4 kg packs. Pool N-M Dual; 1 kg bag. Suspension - 260 + 130 g/L; Mergamma FL; 10 L, 200 L drum.
2. REGISTERED MIXES: None.
3. CROPS: Barley (except Palliser), oats, rye, wheat.
4. FUNGI CONTROLLED:

bunt (rye, wheat)	false loose smut (barley)	root rot (cereals)	stinking smut (wheat)
covered smut (barley, oats)	loose smut (oats)	seedling blight (cereals)	

5. INSECTS CONTROLLED: Wireworms
6. WHEN USED: Pre-seeding or Drill Box Treatment - treat seed before sowing. Seed should be well cured, dry, and cleaned before treatment. Do not store treated seed more than 1 year.
7. HOW TO APPLY: ***Pre-seeding Treatment:*** apply by any standard dry seed treatment application equipment or by the shovel method. Treat only the amount of seed to be used to avoid the problem of storing treated seed. ***Drill Box Treatment:*** At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix powder and seed thoroughly until seed is a uniform colour by either of the following alternate mixing methods (Do NOT mix with hands): (a) Place and level 1/2 of seed in drill box and sprinkle 1/2 of required amount of product uniformly over seed. Mix thoroughly with a stick or paddle. Fill box with seed and sprinkle on remaining 1/2 of product, mix again. OR (b) Dribble the required amount of product into the seed as it is poured into the drill box. Mix thoroughly with a stick or paddle when drill box is 1/2 full and again when full. OR (c) Apply through a mechanical dispenser or proportioner that attaches to the auger that conveys seed into the drill box.

Rate:

Crop	Disease	Insect	Powder g/25 kg seed	Suspension mL/25 kg seed
Barley (except Palliser)	Smuts (covered, false loose), seedling blight, root rot.	Wireworms	65	100
Oats	Smuts, seedling blight, root rot.	Wireworms	90-92	138
Rye	Bunt, seedling blight, root rot.	Wireworms	55-56	84
Wheat	Bunt, stinking smut, seedling blight, root rot.	Wireworms	50-52	78

8. APPLICATION TIPS: • Use only recommended rates. Lower amounts may not give the desired control. Excessive amounts may cause seed injury. •Avoid very deep seeding and exceptionally early sowing under poor growing conditions for maximum benefits.
9. HOW IT WORKS: Maneb is a protective, seed-treatment fungicide. Lindane is an organochlorine insecticide that works by ingestion, contact and, to a lesser extent, by fumigant action against many soil-dwelling insects.
10. GRAZING AND HARVEST RESTRICTIONS: Do not feed treated grain to livestock. Do not leave treated seed exposed to birds, and other wildlife.
11. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = maneb (6,750), lindane (88-270). Lindane is toxic to fish, birds, and other wildlife.
12. PRECAUTIONS, FIRST AID: Wear dust mask, goggles, and gloves. Work in a well ventilated area. Wash thoroughly after handling or before eating or smoking. Any treated stored grain should be labelled ***"Do not use for food or feed. This seed treated with maneb+lindane. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Lindane - may include nausea, vomiting, hyperirritability, convulsions, coma, and other symptoms typical of organochlorine insecticide poisoning. Skin contact with maneb may produce irritation or dermatitis. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Give epsom salts as a laxative, avoid mineral oils and castor oil. Get medical attention. ***For Physician:*** Lindane is an organochlorine insecticide. Barbiturates may be given to control convulsions. Oxygen may be indicated. Keep patient quiet. Avoid use of morphine and adrenaline.
13. STORAGE: Do not store in or around the home, or near food or feed. Keep away from fire and sparks. NEVER allow product to become wet during storage. This may lead to chemical changes which will reduce the effectiveness of fungicide and produce flammable vapors. Keep container closed when not in use.

MERTECT (thiabendazole)

Chipman

1. FORMULATIONS: Suspension; 45%; 4 X 4 L pack.
2. REGISTERED MIXES: Consult with manufacturer before mixing with other chemicals.
3. CROPS: Potatoes, sugar beets.
4. FUNGI CONTROLLED: *Botrytis, Fusarium, Helminthosporium, Oospora, Penicillium, Phoma, Rhizoctonia.*
5. WHEN USED: Once per season. ***Potatoes*** - post-harvest control of storage rot in whole potates. ***Sugar beets*** - foliage treatment for cercospora leaf spot and post-harvest control of storage rot.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate:

Crop	Disease	Quantity
Potatoes	Storage rot	94 (suspension) mL/1000 kg potatoes
Sugar beets (foliar)	Cercospora leaf spot	162-324 mL/ac Mertect
Sugar beets	Storage rot	13 mL Mertect/1000 kg of sugar beets

   Water Volume: 8 L Mertect/170 L water. Spray 2 L of this suspension per metric tonne of potatoes. ***Sugar beets (foliar spray)*** Aircraft - 4-16 L/ac. Ground - 40-202 L/ac ***Sugar beets (storage rot)*** Use sufficient water for complete coverage.
7. APPLICATION TIPS: • Do not allow suspension to stand without continuous agitation. • Potatoes must rotate along the conveyor line to ensure complete coverage. • Prior to treating potatoes destined for export, confirm with the proper authorities that treated potatoes will be allowed entry into the importing country.
8. HOW IT WORKS: Thiabendazole is a fungicide which controls *Botrytis, Fusarium, Helminthosporium, Oospora, Penicillium, Phoma,* and *Rhizoctonia* fungi.
9. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = thiabendazole (3,300). May cause skin irritation.
10. PRECAUTIONS, FIRST AID: Avoid contact with skin, eyes, and clothing. Wash hands, face, and arms after use and before eating, drinking or smoking. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - do NOT induce vomiting, product contains petroleum distillates. Contact a physician.
11. STORAGE: Minimum storage temperature 0°C.

ROVRAL (Iprodione)
May & Baker

1. FORMULATIONS: Wettable Powder; 50%; 1 kg, 8 kg bags. Flowable; Rovral flo; 250 g/L; 2 X 8 L pack.
2. REGISTERED MIXES: With lindane as dual purpose formulation. Addition of 405 g non-ionic wetter is recommended for improved fungicide performance.
3. CROPS: Beans (kidney, snap, white), canola.
4. FUNGI CONTROLLED: Botrytis diseases, sclerotinia stem rot, sclerotinia white mold.
5. WHEN USED: ***Beans:*** Treatment prior to the presence of disease is preferable, however Rovral is still effective if applied at the initial sign of infection, when less than 5% of the plants are showing sclerotinia white mold. Apply when beans are in the 25-75% bloom stage. ***Canola:*** Apply when the crop is at the 20-30% bloom stage. Infection normally occurs in July.
6. HOW TO APPLY:
   With: Aircraft or Ground equipment.
   Rate:

Crop	Disease	g/ac	mL/ac
Canola	*Sclerotinia*	400-600	800-1200
Beans (white, kidney, snap)	*Sclerotinia* and *Botrytis*	400-600	800-1200

   NOTE: Higher rate for fields with a history of heavy disease pressure, or dense crop stands.
   Water Volume: Beans 18 L/ac (air); 121 L/ac (ground). Canola 18 L/ac (air); 40 L/ac (ground).
7. APPLICATION TIPS: • When disease is actively growing in beans, the infection may quickly exceed the point where 5% of plants show mold. • Spray mixture should be used on the day prepared. Good spray coverage is essential.
8. HOW IT WORKS: Rovral is a protective and eradicant fungicide.
9. EXPECTED RESULTS: Prevents disease infestion during the mid-flowering period and thus protects against major yield losses.
10. EFFECTS OF RAINFALL: Do not spray in heavy dew or when rain is imminent.
11. GRAZING AND HARVEST RESTRICTIONS: No restrictions on harvest provided product is applied at the recommended time.
12. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = iprodione (3,500).
13. PRECAUTIONS, FIRST AID: Avoid inhaling mist. A mild eye irritant. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - if patient is concious, wash out mouth. If breathing stops, start artificial respiration. Get medical attention.
14. STORAGE: Store flowable above 0°C.

ROVRAL ST (iprodione + lindane)
Fungicide-Insecticide
May & Baker

DANGER POISON

1. FORMULATIONS: Liquid Flowable; 16.7% iprodione + 50% lindane; 100 L drum.
2. REGISTERED MIXES: None.
3. CROPS: Canola
4. FUNGI CONTROLLED: Blackleg ("seed-borne"), seedling blight caused by *Rhizoctonia solani.*
5. INSECTS CONTROLLED: Flea beetles
6. WHEN USED: Treat seed once before sowing. Do not store treated seed for more than 6 months.
7. HOW TO APPLY:
   With: On-farm treatment - through the auger with special equipment or with an inexpensive pump or dripolator device; or at seed cleaning plant.
   Rate:

Crop	Disease	Insect	mL/25 kg seed
Canola	Blackleg, seedling blight, *Rhizoctonia solani.*	Flea beetles	750 (suspension)

8. APPLICATION TIPS: • Roll drum or stir well before using. • Thorough seed coverage is required. • Treated seed should not require drying after treatment and can be stored or bagged immediately. Treat only the required amount of seed.
9. HOW IT WORKS: Lindane, an organochlorine insecticide that works by ingestion, contact and to a lesser extent, by fumigant action against soil-dwelling insects. Iprodione fungicide protects against seed-borne blackleg and seedling blight caused by *Rhizoctonia solani.*
10. EXPECTED RESULTS: ***Diseases:*** Prevents the above mentioned diseases from developing. ***Insects:*** Protects against flea beetles for approximately 10 days after seeding.
11. MOVEMENT IN SOIL: Does not move in the soil.
12. GRAZING AND HARVEST RESTRICTIONS: Do not leave treated seed exposed to birds or other animals.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (200-400). Lindane is toxic to fish, birds, and other animals.
14. PRECAUTIONS, FIRST AID: Wear a suitable respirator, gloves, and coveralls. Work in a well ventilated area. ***Symptoms of poisoning:*** Lindane - may include nausea, vomiting, hyperirritability, convulsions, coma and other symptoms typical of organochlorine insecticide poisoning. Skin contact with fungicides may produce irritation or dermatitis. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Give epsom salts as a laxative, avoid mineral oils, castor oil, and milk. Get medical attention.
    For Physician: Lindane is an organochlorine insecticide. Barbiturates (e.g. diazepam) may be given to control convulsions. Oxygen may be indicated. Keep patient quiet. Avoid use of morphine and adrenaline.
15. STORAGE: Do not store in the home, or near food or feed. Protect from frost (freezing).

THIRAM 75 WP (thiram)

Uniroyal

1. FORMULATIONS: Wettable Powder; 75%; 1.5 kg, 2.5 kg bag.
2. REGISTERED MIXES: In various combinations with other fungicides (benomyl and carbathiin) and, as dual purpose formulations, with insecticides (chlorfenvinphos, ethion, fensulfothion, fonophos and lindane).
3. CROPS: Alfalfa, beans (dry, snap, soy), corn (sweet), grasses, mustard, peas, sugar beets.
4. FUNGI CONTROLLED: Damping-off, seed decay, seedling blight (corn, beans, grasses, mustard, peas, sugar beets). Verticillium wilt (alfalfa).
5. WHEN USED: Pre-seeding or Drill Box Treatment - treat seed before sowing. Seed should be well cured, dry, and cleaned before treatment.
6. HOW TO APPLY: ***Pre-seeding Treatment*** apply with any standard dry seed treatment application equipment or the shovel method. ***Drill Box Treatment*** At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix product and seed thoroughly until seed is a uniform colour by the following alternate mixing methods (Do NOT mix with hands): (a) Place and level 1/2 of the seed in drill box and sprinkle 1/2 of the required amount of product uniformly over seed. Mix thoroughly with a paddle. Fill box with seed and sprinkle remaining 1/2 of product over seed, mix again. **OR** (b) Dribble the required amount of product into seed as it is poured into drill box. Thoroughly mix with a paddle when drill box is 1/2 full and again when full. **OR** (c) Apply through a mechanical dispenser or proportioner that attaches to the auger that conveys seed into the drill box.

Rate:

Crop	Disease	Powder g/25 kg seed
Alfalfa	Verticillium wilt	90
Grasses, mustard, sugar beet.	Damping-off, seed decay, seedling blight.	90
Bean (dry, snap, soy), pea.	Damping-off, seed decay, seedling blight.	25-35
Corn (sweet)	Damping-off, seed decay, seedling blight.	55

Water Volume: ***Slurry Treatment on alfalfa*** - pre-mix Thiram 75 WP in water as indicated below and apply with commercial seed treating equipment.

kg Thiram 75 WP	L of water	kg of seed treated
1.5	5	450
3.0	10	900
4.5	15	1350

7. APPLICATION TIPS: Mustard - mix powder and seed in drill box. Simultaneous treatment with an insecticide for control of flea beetles is recommended (see also the manual sections on carbofuran and lindane).
8. HOW IT WORKS: Thiram is a protective fungicide applied as a foliar spray or a seed-treatment powder.
9. GRAZING AND HARVEST RESTRICTIONS: Do not feed treated seed to livestock. Do not expose treated seed to birds and other wildlife. ***Foliar Treatment:*** Do not graze treated area or feed clippings from treated area. ***Seed Treatment:*** Do not graze for 4 weeks after planting.
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = thiram (780-865), product (800-3100). May irritate eyes, nose, throat or skin. May cause allergenic eczema in sensitive individuals.
11. PRECAUTIONS, FIRST AID: Avoid breathing dust or spray mist. Wear suitable mask, goggles, and gloves. Keep away from fire or sparks. Wash thoroughly after handling and before eating, drinking or smoking. Consumption of alcohol 24 hours before and after working with thiram or thiram-treated seed may cause sweating, flushing and nausea. Stored treated grain should be labelled ***"Do not use for food or feed. This seed as been treated with thiram. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately. Take labelled container with you.
12. STORAGE: Store in a cool, dry, ventilated place away from food or feed. Keep away from fire or sparks.
13. DECONTAMINATION AND DISPOSAL: Wash contaminated clothing with soap and hot water before wearing.

VITAVAX DUAL POWDER, VITAVAX RS (carbathiin + thiram + lindane)
Fungicide-Insecticide
Uniroyal

DANGER POISON

1. FORMULATIONS: Dusts - Vitavax Dual Powder; 20.0 + 28.9 + 18.7%; 1.5 kg tube. - Vitavax rs Powder; 3.3 + 6.7 + 50.0%; 1.5 kg tube. Suspension; Vitavax rs Flowable; 45 + 90 + 680 g/L; 4 L, 100 L containers.
2. CROPS: ***Vitavax Dual Powder:*** barley, flax, oats, rye, wheat. ***Vitavax rs:*** canola, mustard.
3. FUNGI CONTROLLED:

blackleg (canola)	damping-off (flax, rye)	seedling blight (canola, flax)
bunt (wheat)	false loose smut (barley)	stem smut (rye)
covered smut (barley, oats)	seed decay (canola, flax, rye)	true loose smut (barley, oats, wheat)

4. INSECTS CONTROLLED: Flea beetles (canola), wireworms (barley, oats, rye, wheat).
5. WHEN USED: Pre-seeding or Drill Box Treatment - treat seed before sowing. Seed should be well cured, dry, and cleaned before treatment. Do not store seed treated with powder. Seed treated with flowable should be tested for germination before planting if stored for more than 6 months.
6. HOW TO APPLY: ***Pre-seeding Treatment:*** Flowable can be applied in a continuous treating operation with S-Series Treaters or OFT Treaters (Uniroyal), batch treaters, or cement mixers. ***Drill Box Treatment:*** At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix powder and seed thoroughly until seed is a uniform colour. Do NOT mix with hands. Fill drill box to 1/2 capacity and sprinkle required amount of powder over seed. Mix with a paddle. Add seed to fill the box, cover with remaining powder and repeat. For large drill boxes, divide seed into several portions.
With: Seed-dressing equipment. Clean planter plates periodically to prevent excessive build-up of chemicals.
Rate:

Crop	Disease	Insect	Dual g/25 kg seed	rs Powder g/25 kg seed	rs Flowable mL/25 kg seed
Barley	Smuts (covered, false loose, true loose)	Wireworms	70	-	-
Canola, mustard.	Blackleg, seed decay, seedling blight.	Flea beetles		750	562
Flax	Damping-off, seed decay, seedling blight.	Wireworms	70	-	-
Oats	Smuts (covered, loose)	Wireworms	95	-	-
Rye	Damping-off, seed decay, stem smut.	Wireworms	60	-	-
Wheat	Bunt, smuts (stinking, true loose).	Wireworms	65	-	-

7. APPLICATION TIPS: • Important that seed and chemical are mixed quickly and uniformly. • Prior to and during treatment, product should be kept at about 10°C for best results. • Run auger at less than capacity to provide adequate mixing. • Under treatment results in loss of efficacy and over treatment may reduce germination.
8. HOW IT WORKS: Lindane (an organochlorine insecticide) acts by ingestion, contact and, to a lesser extent, by fumigant action against many soil-dwelling and phytophagous insects. Thiram, a fungicide, controls seed-borne diseases. Carbathiin, a systemic fungicide, penetrates the seed coat to control diseases of the seed and seedling.
9. GRAZING AND HARVEST RESTRICTIONS: Do not use treated seed for feed, food or oil processing. Do not graze or feed livestock on treated areas for 4 weeks after planting.
10. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = Vitavax rs (302); carbathiin (3,820), thiram (780-865), lindane (88-270).
11. PRECAUTIONS, FIRST AID: Read the label before using any product. Work in a well ventilated area and wear a dust mask, goggles, and rubber gloves. Consumption of alcohol 24 hours before or after working with thiram may cause sweating, flushing, headache and nausea. Label stored, treated seed with ***"Do not use for food, feed, or oil processing. This seed has been treated with carbathiin+thiram+lindane. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** With lindane - nausea, vomiting, hyperirritability, convulsions, coma. Skin contact with fungicides may result in irritation and dermatitis. ***First Aid:*** IF IN EYES - flush immediately with running water. Get medical attention. IF ON SKIN - wash with warm water and soap. IF SWALLOWED - induce vomiting (see page 6). Keep patient quiet. Get medical attention immediately.
12. STORAGE: Do not store in or around the home. Store powder in a dry area. Do not store below 0°C or exceed 25°C.

VITAVAX DUAL SOLUTION (carbathiin + lindane)
Fungicide-Insecticide
Uniroyal

1. FORMULATIONS: Solution; 180 + 165 g/L; 4 L, 10 L, 200 L containers.
2. REGISTERED MIXES: carbathiin + lindane are mixed with thiram to produce: Vitavax rs Flowable, Vitavax rs Powder, Vitavax Dual Powder.
3. CROPS: Barley, oats, wheat.
4. FUNGI CONTROLLED: Bunt (wheat), covered smut (barley, oats), false loose smut (barley), true loose smut (barley, oats, wheat).
5. INSECTS CONTROLLED: Wireworms (barley, oats, wheat).
6. WHEN USED: Pre-seeding Treatment - treat seed before sowing. Seed should be well cured, dry, and cleaned before treatment.
7. HOW TO APPLY:
   With: On-farm treatment using an auger with a pump or dripolater device or custom application at seed cleaning plants.
   Rate:

Crop	Disease	Insect	mL/25 kg seed
Barley	Smuts (covered, false loose, true loose)	Wireworms	75-90*
Oats	Smuts (covered, loose)	Wireworms	75
Wheat	Bunt, true loose smut.	Wireworms	75-90*

   NOTE:* For wheat and barley varieties highly susceptible to true loose smut and for high levels of smut or bunt on seed, the 90 mL rate will give increased disease control. Treated seed may give increased yields for crops growing under stress conditions such as disease, cool weather, and drought.
   Water Volume: Do NOT dilute with water.
8. APPLICATION TIPS: • Run auger at less than capacity to ensure adequate mixing. • Under treatment will result in loss of efficacy and over treatment may result in reduced germination.
9. HOW IT WORKS: Carbathiin, a systemic fungicide, penetrates the seed coat to control diseases of the seed and seedling. Lindane (an organochlorine) acts by ingestion, contact, and to a lesser extent, by fumigant action against many soil dwelling and phytophagous insects.
10. GRAZING AND HARVEST RESTRICTIONS: Do not graze or feed livestock on treated areas for 4 weeks after planting. Do not use treated seed for feed, food, or oil processing.
11. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = Vitavax Dual Solution (1740); carbathiin (3820), lindane (88-270). Lindane is toxic to fish, birds, and other wildlife.
12. PRECAUTIONS, FIRST AID: Work in well ventilated area. Wear suitable mask, goggles, and butyl rubber gloves. Avoid breathing vapors. Wash all exposed areas with soap and water after use and before eating or smoking. Do not reuse bags or augers used for treated seed. Label stored treated seed ***"Do not use for food, feed, or oil processing. This seed has been treated with carbathiin + lindane. POISONOUS TO MAN AND ANIMALS."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Apprehension, twitching, tremors, and convulsions. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - induce vomiting (see page 6). Get medical attention immediately. Take labelled container with you. ***For Physician:*** There is no specific antidote. If swallowed, INTUBATE the stomach. Treat as solid organochlorine pesticide poisoning. Diazepam is the anticonvulsant of choice.
13. STORAGE: Do not store below 0°C.

VITAVAX POWDER (carbathiin + thiram)

Uniroyal

WARNING POISON

1. FORMULATIONS: Dust; 26.7 + 38.8%; 1.5 kg tube.
2. REGISTERED MIXES: With the insecticide lindane to produce: Vitavax Dual Powder, Vitavax rs Flowable, Vitavax rs Powder.
3. CROPS: Barley, flax, oats, rye, soybeans, wheat.
4. FUNGI CONTROLLED:

bunt (wheat)	damping-off (flax, rye, soybeans)	stem smut (rye)
covered smut (barley, oats)	seed decay (flax, rye, soybeans)	true loose smut (barley, oats, wheat)

5. WHEN USED: Drill Box Treatment - treat seed before sowing. Seed shoud be well cured, dry, and cleaned before treatment. Do not store treated seed.
6. HOW TO APPLY: At the start, treat enough seed in a separate container to cover bottom of empty drill box. Mix product and seed thoroughly until seed is a uniform colour with a stick or paddle. Do NOT mix with hands. Fill the drill or planter box to 1/2 capacity and sprinkle 1/2 the required amount of powder over the seed and mix thoroughly. Seed should all be pink. Then add enough seed to fill the box, cover with the remaining powder and repeat mixing procedure. For large drill or planter boxes, it may be necessary to divide the seed into several portions. Clean planter plates periodically to prevent excessive build-up of treatment chemicals.

Rate:

Crop	Disease	g powder/25 kg seed
Barley	Smuts (covered, false loose, true loose)	50
Flax	Damping-off, seed decay, seedling blight.	60
Oats	Smuts (covered, loose)	70
Rye	Damping-off, seed decay, stem smut.	45
Soybeans	Damping-off, seed decay.	65
Wheat	Bunt	40
	Smuts (true loose)	55

7. APPLICATION TIPS: • Vitavax Powder has no vapor action, therefore thorough seed coverage is required. • Seeding rate should be checked before planting and periodically during planting.
8. HOW IT WORKS: Thiram is a fungicide which controls diseases carried on the seed. Carbathiin is a systemic fungicide which penetrates the seed coat to control diseases inside the seed and seedling.
9. GRAZING AND HARVEST RESTRICTIONS: Do not use treated seed for feed, food or oil processing. Do not graze or feed livestock on treated areas for 4 weeks after planting.
10. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = carbathiin : thiram (1,600).
11. PRECAUTIONS, FIRST AID: Read the label before using any product. Work in well ventilated area and wear a dust mask, goggles and gloves. Do not consume of alcohol within 24 hours before or after working with thiram; may cause flushing, sweating, headache and nausea. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** skin contact may result in irritation and dermatitis. ***First Aid:*** IF IN EYES - flush immediately with running water. Get medical attention. IF ON SKIN - wash with warm water and pumice soap to remove dye. IF SWALLOWED - induce vomiting (see page 6). Keep patient quiet. Get medical attention immediately.
12. STORAGE: Do not store product in or around the home or near food or feed. Store powder in a dry area.

VITAVAX SINGLE SOLUTION (carbathiin)

Uniroyal

1. FORMULATIONS: Solution; 230 g/L; 4 L, 10 L, 200 L containers.
2. REGISTERED MIXES: With the fungicide thiram to produce: Vitavax Powder. With the insecticide lindane to produce Vitavax Dual Solution. With thiram and lindane to produce: Vitavax Dual Powder, Vitavax rx Flowable, Vitavax rs Powder.
3. CROPS: Barley, flax, oats, rye, wheat.
4. FUNGI CONTROLLED:

bunt (wheat)	false loose smut (barley)	stem smut (rye)
covered smut (barley, oats)	seed decay (flax)	true loose smut (barley, wheat)
damping-off (flax)		

5. HOW TO APPLY:
With: On-farm treatment - through the auger with special equipment or with an inexpensive pump or dripolator device; or at seed cleaning plant.
Rate:

Crop	Disease	mL/25 kg seed
Barley	Smuts (covered, false loose, true loose)	60-75*
Flax	Damping-off, seed decay, seedling blight.	100
Oats	Smuts (covered, loose)	60
Rye	Stem smut	60
Wheat	Bunt, true loose smut.	60-75*

***NOTE:**
For wheat and barley varieties highly susceptible to true loose smut and for high levels of smut or bunt on seed, the 75 mL rate will give increased disease control. Treated seed will give increased yields for crops growing under stress conditions such as disease, cool weather and drought.
Water Volume: Do NOT dilute with water.
6. APPLICATION TIPS: • Run auger at less than capacity to provide adequate mixing. • Under treatment results in loss of efficacy and over treatment may reduce germination.
7. HOW IT WORKS: Carbathiin a systemic fungicide, penetrates the seed coat to control disease.
8. GRAZING AND HARVEST RESTRICTIONS: Treated seed not to be used for food, feed, or oil processing. Do not graze feed livestock on treated areas for 4 weeks after planting.
9. TOXICITY: Very low acute mammalian toxicity. Acute *oral* LD_{50} rats (mg/kg) = carbathiin (3,820).
10. PRECAUTIONS, FIRST AID: Read the label before using any product. Work in a well ventilated area. When treating seed, augering or handling treated seed, wear a dust mask, goggles, and butyl rubber gloves. Do not get in eyes or on skin. Avoid breathing vapours. Do not reuse bags from treated seed or auger used for treated seed for other purposes. Label stored treated seed ***"Do not use for food, feed, or oil processing. This seed has been treated with carbathiin."*** KEEP OUT OF REACH OF CHILDREN. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - Do NOT induce vomiting. Get medical attention immediately.
11. STORAGE: Store above 0°C. Do not store in or around the home.

NOTES

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CHEMICAL CONTROL OF RODENTS IN ALBERTA

Introduction:

Rodent problems are usually related to human cultural practises. Understanding how to modify certain activities or situations will help prevent or reduce problems with rodents. For example, pastures should not be overgrazed as this encourages proliferation of ground squirrels. Adequate shelter and food are important factors for mice in buildings and dwellings. Mouse numbers can be drastically reduced by eliminating their shelter and food source. However, not all rodent problems can be corrected by management or cultural changes.

Chemical control, combined with management and cultural modifications, is usually necessary to eliminate established rodent populations and prevent recurrence.

This section contains information on chemicals used to control ground hogs, ground squirrels, mice, pocket gophers, and rabbits in Alberta.

ANTICOAGULANTS

[bromodialone, chlorophacinone, diphacinone, warfarin, warfarin + sulfaquinoxaline]
Numerous Manufacturers
[brodifacoum (Chipman/Wilson)], [warfarin + ergocalciferol (Ciba-Geigy)]

1. FORMULATIONS:

Formulation	Active Ingredient (AI)	Concentration (AI)	Container Sizes
Bait block	Bromodialone, chlorophacinone, diphacinone.	0.005%	450 g to 9 kg
Dust or powder	Warfarin	0.5%	100 g
Extruded pellets	Brodifacoum, bromodialone, chlorophacinone.	0.005%	50 g to 20 kg
	Warfarin + sulfaquinoxaline	0.025% + 0.025%	500 g to 1 kg
Liquid concentrate	Chlorophacinone	0.28%, 0.7%	1 L, 4 X 1 L pack
Meal	Bromodialone, chlorophacinone.	0.005%	20 g to 20 kg
	Warfarin	0.025%	454 g to 20 kg
	Warfarin + ergocalciferol	0.025% + 0.1%	500 g, 10 kg
	Warfarin + sulfaquinoxaline	0.025% + 0.025%	500 g to 10 kg
Soluble granules	Warfarin	0.5%	11.3 g

2. REGISTERED MIXES: Use as directed on container label. Brodifacoum and bromodialone are single-feeding anticoagulants; all others are multiple-feeding anticoagulants.

3. REGISTERED USES:

	Products						
	Chlorophacinone	Diphacinone	Warfarin (W)	W + Ergocalciferol	W + Sulfaquinoxaline	Brodifacoum	Bromodialone
MICE:							
Farm Buildings	X	X	X	X	X	X	X
Food Sources	X	X	X	X	X	X	X
Fruit trees, ornamentals, vines.	X	X	X	X	X	X	X
Garbage dumps		X	X	X	X	X	X
Graineries (empty)	X	X	X	X	X		
Human dwellings	X	X	X		X	X	X
Nurseries					X		
Orchards	X	X			X		
Other storage buildings	X	X	X	X	X	X	X
Outdoor living areas (parks, playgrounds)					X		
Sewers	X	X	X				
Woodlands	X	X					

GROUND SQUIRREL: Chlorophacinone and dipachinone in farmyards, pasture/rangeland, forage/field crops, gardens, nurseries, turf, residential areas.

4. ANIMALS CONTROLLED: Ground squirrels, mice, voles (field mice).

5. WHEN USED: ***Ground squirrel:*** Best results occur when used just prior to spring vegetation regrowth. ***Mice:*** Best results when used after removal of other food sources. ***Number of Applications:*** Brodifacoum and bromodialone - 1 usually effective. Can be re-applied after 1 week if mice still present. All other anticoagulants - maintain uninterrupted supply of bait until feeding ceases.

6. HOW TO APPLY:
   With: Hand application to bait stations or burrows.
   Rate:

Bait Station	Animal	Formulation
500 g/station every 30-60 m of infested area depending on animal density.	Ground squirrel	Pellets, liquid concentrate.
15-50 g/protected station at intervals of 2-3 m.	Mice	Meal, pellets, dust/powder, liquid concentrate.
1 or 2 blocks/station at intervals of 2-3 m.	Mice	Bait blocks
One 11.3 g packet/L of water in chick fountain or shallow dish near feeding sites.	Mice	Soluble granules
Burrows		
15-20 g/burrow	Ground squirrel	Pellets, liquid concentrate.

7. APPLICATION TIPS: ***Bait Station:*** Place bait in inaccessible areas or in secure bait stations that cannot be turned over or broken into by children, pets, or wild or domestic animals. ***Burrows:*** Place bait far into burrow with long spoon. This makes it inaccessible to non-target animals.
8. HOW THEY WORK: ***Anticoagulant rodent poisons*** interfere with clotting of blood and cause damage to tiny blood vessels. They prevent formation of prothrombin by competition with vitamin K. Rate of blood clotting is gradually reduced and the animal bleeds to death. ***Ergocalciferol*** mobilizes calcium and causes death from organ calcification and heart attack. ***Sulfaquinoxaline*** is an antibacterial agent that increases the effectiveness of warfarin by inhibiting intestinal bacteria that produce vitamin K.
9. EXPECTED RESULTS: Rodents usually begin to die 3 to 4 days after they ingest anticoagulants.
10. EFFECTS OF RAINFALL: Can result in deterioration and molding of exposed bait. Extended rainfall will also effect field rodent activities, reducing bait uptake.
11. MOVEMENT IN SOIL: Negligible at recommended rates.
12. GRAZING AND CROPPING RESTRICTIONS: Do not use ground squirrel bait stations in areas accessible to livestock or pets.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = brodifacoum (0.27), bromodialone (1.12), chlorophacinone (5.0), diphacinone (3.0), warfarin (50-100). Potentially toxic to birds and other animals.
14. PRECAUTIONS, FIRST AID: Wear gloves. Wash hands after using. Label bait stations ***"POISON"***. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** pallor and weakness from blood loss, bloody nose and feces, internal bleeding, swelling and discolouration from blood in tissue. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6). Get medical attention.
15. STORAGE: Store in locked room or container. Do not store with other pesticides or chemicals; rodents are repelled by contaminated bait. Keep bait in original container.

GASEOUS OXIDES OF SULPHUR (gas cartridges)

Dexol/Sanex

1. FORMULATIONS: Granular solid within cardboard cylinder; major ingredients - sodium nitrate, charcoal, sulphur (contains various components depending on manufacturer); 75-85 g/cylinder, 3 cylinder package.
2. REGISTERED MIXES: None.
3. REGISTERED USES: Farmyards, forage/field crops, gardens, nurseries, orchards, outdoor living areas, pasture/rangeland, residential areas*, turf.
   *=populated areas, such as cities and large campgrounds.
4. ANIMALS CONTROLLED: Ground hog, ground squirrel, pocket gopher.
5. WHEN USED: Spring through fall when rodents are active and causing damage.
6. HOW TO APPLY: Place fuse in a sulphur oxide cartridge, light fuse and insert cartridge as far as possible into rodent burrow. When cartridge begins to burn, plug burrow with soil to prevent smoke from escaping.
   Rate: 1 cartridge/rodent burrow is usually sufficient.
7. APPLICATION TIPS: During gasing operation, watch for smoke exiting nearby burrows and plug these also.
8. HOW IT WORKS: As a cartridge ignites, smoke and toxic gases are produced and fill the rodents' burrow. Rodents are killed by asphixiation as a result of breathing the toxic fumes.
9. EXPECTED RESULTS: Death of rodents inhabiting burrows that were treated. ***Poor results may be expected if:*** cartridges are used to attempt control of pocket gophers and ground squirrels that have well established burrow systems. All areas of an extensive burrow system will not be penetrated by toxic gases from a cartridge. These areas provide a retreat for inhabiting rodents.
10. EFFECTS OF RAINFALL: None.
11. MOVEMENT IN SOIL: None.
12. GRAZING AND CROPPING RESTRICTIONS: None.
13. TOXICITY: High acute mammalian toxicity in enclosed area. 1000 mg/kg of carbon monoxide, a major product of combustion, produces symptoms of poisoning.
14. PRECAUTIONS, FIRST AID: Avoid prolonged breathing of fumes. Do not use under wooden buildings or flammable material. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** same as carbon monoxide. Tightness across forehead, headache, throbbing at the temples, dizziness, weariness, nausea, vomiting, collapse, and unconsciousness. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF INHALED - remove victim to fresh air and keep him lying down. If breathing has stopped, apply artificial respiration. Seek medical attention.
15. STORAGE: Store in cool, dry place as cartridges will absorb water. Keep under lock and key.

REPEL SPREADER-STICKER 268 (ammonia+soap)

Leffingwell

1. FORMULATIONS: Liquid Concentrate; 1.5% ammonia + 14.1% soap; 4 L container.
2. REGISTERED MIXES: Do not apply with other additives or pesticides.
3. REGISTERED USES: Forage/fieldcrops, fruit trees, gardens, non-crop areas, nurseries, ornamentals, vines.
4. ANIMALS CONTROLLED: rabbits.
5. WHEN USED: As needed. Apply in fall, prior to snowfall, for control of expected winter damage.
6. HOW TO APPLY:
   With: Paint brush, sprayer.
   Rate: ***Forage/grain crops, non-crop areas:*** 435-725 mL product in 100 L of water. Apply thoroughly to a 3-5 m wide strip around border of area to be protected. ***Fruit trees, vines:*** 435-725 mL product in 100 L of water. Spray thoroughly. Hand painting, mix 50:50 of product and water. Apply to areas normally reached by rabbits. ***Nursery stock, ornamentals:*** 290-570 mL product in 100 L of water. Apply thoroughly in a full coverage spray. ***Vegetables, field crops:*** 290-580 mL product in 100 L of water at 182-385 L/ac.
7. APPLICATION TIPS: For best results, apply spray to point of runoff.
8. HOW IT WORKS: An animal taste repellant which discourages feeding on trees and other vegetation.
9. EXPECTED RESULTS: Rabbits stop feeding, or are discouraged from feeding on vegetation treated with this product. ***Poor results may be expected if:*** product is applied improperly or at an insufficient strength or amount. Watering or a rain before the product has dried will also reduce effectiveness.
10. EFFECTS OF RAINFALL: Do not apply if raining or expected rain within 24 hours of application.
11. MOVEMENT IN SOIL: None at recommended rates.
12. GRAZING AND CROPPING RESTRICTIONS: Do not apply to food crops within 14 days of harvest.
13. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (5000).
14. PRECAUTIONS, FIRST AID: Wear gloves. Wash hands after use. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). Get medical attention for eyes. IF SWALLOWED - drink promptly a large quantity of milk, egg whites, gelatin solution, or if these are not available, drink large quantities of water. Avoid alcohol. Get medical attention.
15. STORAGE: Store under lock and key, in original containers.

RO-PEL (benzyldiethyl (2,6 xylyl carbamoyl) methyl ammonium saccharide)

Burlington

1. FORMULATIONS: Liquid; 0.065%; 946 mL spray bottle, 3.78 L bottles, 18.9 L, 207.8 L drums.
2. REGISTERED MIXES: Never mix with other chemicals. Use full strength.
3. REGISTERED USES: Fruit trees, gardens, nursery stock, ornamentals.
4. ANIMALS CONTROLLED: Mice, porcupine, rabbits, voles.
5. WHEN USED: Spring to fall. Before damage is caused or to prevent further damage. A second application may be necessary on new vegetation growth.
6. HOW TO APPLY: Apply to areas of damage or on areas normally damaged by rodents. ***DO NOT APPLY TO EDIBLE PARTS OF TREES OR PLANTS.***
   With: Brush or Sprayer.
   Rate: Generously apply to all surfaces to be protected until completely wet. Apply second coat for extra protection.
7. APPLICATION TIPS: • Allow first treatment to dry before reapplying. • Do not apply on windy or rainy days. Application on dry surfaces is preferable. • Although this product is not toxic to plants or trees, do not use on diseased specimens.
8. HOW IT WORKS: A taste repellant. Attempts by rodents to eat or chew on treated areas results in a bitter taste.
9. EXPECTED RESULTS: Prevention of rodent damage to treated areas of plants. ***Poor results may be expected if:*** plants improperly treated or improper amount applied.
10. EFFECTS OF RAINFALL: Do not apply when raining or if rain is forecast. Rain will wash product from treated areas.
11. MOVEMENT IN SOIL: None.
12. GRAZING AND CROPPING RESTRICTIONS: Do not apply to edible parts of crops or plants, fruit, or nuts.
13. TOXICITY: Very low acute mammalian toxicity. Acute oral LD_{∞} rats (mg/kg) = (greater than 1,500). Non-toxic to plant and animal life.
14. PRECAUTIONS, FIRST AID: Avoid contact with eyes, skin, food, and clothing. Wear gloves when applying. Do not smoke or eat while applying. KEEP OUT OF REACH OF CHILDREN. IF IN EYES - flush with plenty of water and get medical attention. IF ON SKIN - wash first with isoropyl or ethyl alcohol, then soap and water. If an irritation develops and persists, get medical attention. ***Symptoms of poisoning:*** unknown. IF SWALLOWED - unlikely as product has extremely bitter, vile taste. However, several glasses of water, then vomiting by sticking finger down throat should be used if necessary. Get medical attention.
15. STORAGE: Store in cool area, preferably under lock and key.

STRYCHNINE

Elston/May & Baker/Sanex/Savolite

1. FORMULATIONS: Pellet; 0.35%; 454 g jar, 2.27 kg bag, 18.2 kg bag. Liquid Concentrate; 2% and 5%; 250 mL can, 36 X 250 mL pack.
2. MARKETING CATEGORY: Restricted. A record of the user's name, address, land location and signature must be kept by distributors.
3. REGISTERED MIXES: Use according to label.
4. REGISTERED USES: Forage/field crops, pasture/rangeland.
5. ANIMALS CONTROLLED: Ground squirrel, pocket gopher.
6. WHEN USED: Best results when used in early spring prior to vegetation regrowth. ***Number of applications: Ground squirrel*** - 1 application often effective. Rebait active burrows after 5 days. ***Pocket gopher*** - Rebait active burrows 10-14 days after initial treatment. If burrow builder used for first treatment, hand baiting should be used for followup. Use traps for final clean-up.
   Rate: ***Ground squirrel*** - add 250 mL can of 2% liquid concentrate to 4 L of quality oat groats or wheat. Mix well. Place 5 mL of bait into each burrow. ***Pocket gopher*** - add 250 mL can of 5% liquid concentrate to 4 L of quality oat groats, wheat, or diced carrots. Mix well. Place 5 mL of bait into each burrow. With burrow builder use about 1.11 L of bait/ac.
7. APPLICATION TIPS: ***Ground squirrel*** - Place bait far into burrow with long spoon to prevent non-target poisoning. Pick up dead rodents to prevent poisoning of scavenging animals. ***Pocket gopher*** - Hand baiting, use commercial probe or metal bar to locate burrow. Seal each probe hole after bait is put in. Tractor-drawn burrow builder, follow machine use instructions.
8. HOW IT WORKS: Enters the blood and acts on the central nervous system. Symptoms appear from 5-30 minutes after ingestion. Convulsions lead to death from respiratory failure.
9. EXPECTED RESULTS: Reduction or elimination of rodents in control area. ***Poor result may occur if:*** baiting is conducted in summer after vegetation growth has established. Bait acceptance is poor at this time. Bait quality and poorly mixed bait will also effect results.
10. EFFECTS OF RAINFALL: None if applied correctly within burrows.
11. MOVEMENT IN SOIL: None at recommended rates.
12. GRAZING AND CROPPING RESTRICTIONS: None, if applied as recommended. Toxic to cattle.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD_{∞} rats (mg/kg) = (12). Toxic to birds and other animals.
14. PRECAUTIONS, FIRST AID: Wear gloves. Use care when opening cans of liquid concentrate. Label bait container ***"POISONOUS TO MAN AND ANIMALS. This bait contains strychnine."*** KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Frequent convulsions with intervals of quiescent periods. Body stiffens and arches, breathing stops. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - less than 10 minutes earlier, induce vomiting with water then finger down throat. If symptoms have begun, do NOT induce vomiting as this will initiate convulsions and the victim may choke. Force absolute quiet. Lie victim in a darkened room, keep quiet and warm. Get medical attention.
15. STORAGE: Keep bait in sealed, well marked containers prior to use or when stored. Keep under lock and key. Do not freeze.

THIRAM

Numerous Manufacturers (i.e. Uniroyal)

WARNING POISON

1. FORMULATIONS: Liquid; 13% solution, 120 g/L suspension; 4 L container.
2. REGISTERED MIXES: Use as directed. Do not mix with other pesticides when used as rodent repellant.
3. REGISTERED USES: Fruit trees, nursery stock, orchards, woody ornamentals.
4. ANIMALS CONTROLLED: Mice, rabbits.
5. WHEN USED: Apply during spring and fall, before damage occurs or to prevent further damage. To prevent damage over winter, apply in fall prior to cold temperatures and snowfall. APPLY AT TEMPERATURES ABOVE 4°C.
6. HOW TO APPLY: Product can be sprayed, brushed on, or in the case of planting stock; plants can be dipped.
   With: Paint brush, sprayer.
   Rate: ***Brushing*** - Thoroughly apply undiluted product with paint brush on areas of potential or occuring damage. ***Dipping*** - When planting, dip the tops of young trees or plants into undiluted product. ***Spraying*** - Mix product with equal volume of water. Apply to point of runoff.
7. APPLICATION TIPS: Use immediately after being mixed with water. Keep container tightly closed to prevent evaporation.
8. HOW TO WORKS: A taste repellant. Rodents are discouraged from feeding on vegetation that is treated with this product.
9. EXPECTED RESULTS: Prevention of rodent damage to areas treated.
10. EFFECTS OF RAINFALL: Heavy rains can wash part of the product off the treatment site. Do not apply if raining or if threat of rain exists.
11. MOVEMENT IN SOIL: None.
12. GRAZING AND CROPPING RESTRICTIONS: Do not apply to plant parts used for food or feed.
13. TOXICITY: Moderate acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (560-780). Skin contact or inhalation may cause irritation of the nose, throat, or skin and may induce an allergic reaction.
14. PRECAUTIONS, FIRST AID: Wash thoroughly after handling. Wash contaminated clothes with soap and water before reuse. Do not consume alcohol immediately before or within 24 hours after use of Thiram. Avoid breathing spray mist. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Nausea, vomiting, diarrhea, anorexia, hyperactivity and hypothermia. ***First Aid:*** IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - induce vomiting (see page 6).
15. STORAGE: Store in a cool, dry, ventilated place, away from feeds and food. Keep away from heat, fire, and sparks.

ZINC PHOSPHIDE

Kemsan / Pfizer / Sanex

1. FORMULATIONS: Extruded Pellet; 2.0%; 1.36 kg bottle, 6 X 454 g pack, 22.7 kg bag.
2. REGISTERED MIXES: Use according to product label.
3. REGISTERED USES: ***Ground squirrel, pocket gopher*** - Farm buildings (ground squirrel only), farmyards, forage / field crops, gardens, nurseries, pasture / rangeland, residential areas, turf. ***Mice, voles*** - Dwellings, farm buildings, farmyards, orchards, storage areas.
4. ANIMALS CONTROLLED: Ground squirrel, mice, pocket gopher, voles.
5. WHEN USED: ***Deer mice, voles*** - apply in orchards prior to snowfall and before leaf fall and lodging of grass. Use indoors within bait stations according to label and as necessary. ***Ground squirrel, pocket gopher*** - for best results, apply in early spring before vegetation regrowth. ***Number of applications: Ground squirrel:*** Plug all burrows 5 days after treatment, rebait opened burrows next day. ***Mice, voles:*** Inside maintain uninterrupted supply until feeding ceases. Outside re-apply after 2 weeks if mice still present. ***Pocket gopher:*** Re-apply after 10 days where rodents still active.
6. HOW TO APPLY:
   With: Bait stations, burrow builder, cyclone seeder, hand baiting.
   Rate: ***Ground squirrels:*** 5 g far into each burrow. ***Mice, voles:*** Inside areas, place 5 g in protected bait stations every 2-4 m. Outdoor areas, apply with cyclone spreader at 405 g-1.6 kg / ac. 15 g around trees. If hazard to other animals exists, place 15 g of bait in protected bait stations every 2-4 m. ***Pocket gopher:*** 5 g of bait into burrow using commercial or home-made probe.
7. APPLICATION TIPS: ***Ground squirrel*** - Do not apply on bare ground. Never place bait in unprotected heaps or piles. ***Pocket gopher*** - Treat near fresh soil mounds. Plug probe hole after applying bait.
8. HOW IT WORKS: On contact with dilute acids of the stomach, phosphine is released. Death results from asphyxia.
9. EXPECTED RESULTS: Reduction or elimination of rodent population.
10. EFFECTS OF RAINFALL: Exposed bait can become neutralized and ineffective within several days. Paraffin coated pellets should be used for outdoor purposes to prevent rapid breakdown of toxicity.
11. MOVEMENT IN SOIL: None, breaks down rapidly to phosphine.
12. GRAZING AND CROPPING RESTRICTIONS: None if applied properly and at given rates.
13. TOXICITY: High acute mammalian toxicity. Acute oral LD_{50} rats (mg/kg) = (27). Toxic to all birds and other animals.
14. PRECAUTIONS, FIRST AID: Wear gloves. Wash hands after use. Keep unused bait in original container. KEEP OUT OF REACH OF CHILDREN. ***Symptoms of poisoning:*** Nausea, vomiting (black vomitus with smell of phosphine), abdominal pain, chest tightness, excitement and cold sensations. IF IN EYES or ON SKIN - use standard first aid measures (see page 6). IF SWALLOWED - call doctor or poison control centre immediately. Drink 2 glasses of water and induce vomiting by sticking finger down throat. Avoid use of all oils. Keep patient lying down and warm. Do not induce vomiting or give anything by mouth to an unconscious person.
15. STORAGE: Do not store with other chemicals or pesticides, as the bait will become contaminated. Store under lock and key. Store bait in original container. Keep away from moisture.